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CONNECTICUT RIVER FLOOD CONTROL

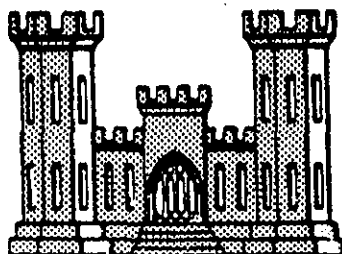
CONANT BROOK

DAM & RESERVOIR

CONANT BROOK, MASSACHUSETTS

DESIGN MEMORANDUM NO. 5

GENERAL



**U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.**

APRIL 1963

407-362

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND

CORPS OF ENGINEERS

424 TRAPELO ROAD

WALTHAM 54, MASS.

ADDRESS REPLY TO:
DIVISION ENGINEER

REFER TO FILE NO.

NEDGW

22 April 1963

SUBJECT: Conant Brook Dam and Reservoir - Conant Brook,
Chicopee River Basin, Massachusetts - Design
Memorandum No. 5, General Design

TO: Chief of Engineers
ATTN: ENGCW-E
Department of the Army
Washington 25, D. C.

There is submitted herewith for review and approval Design Memorandum No. 5 - General Design for the Conant Brook Dam and Reservoir, Conant Brook, Chicopee River Basin, Massachusetts, in accordance with EM 1110-2-1150.

FOR THE DIVISION ENGINEER:


JOHN WM. LESLIE
Chief, Engineering Division

Incl (10 cys)
Des. Memo No. 5 -
General Design

FLOOD CONTROL PROJECT
CONANT BROOK DAM AND RESERVOIR

CONANT BROOK

CHICOPEE RIVER BASIN
MASSACHUSETTS

<u>Design Memo No.</u>	<u>Title</u>	<u>Submission Date</u>	<u>Approved</u>
1	Hydrology & Hydraulics	29 Mar 1963	
2	Detailed Design of Structures		
3	Embankments and Foundations		
4	Concrete Materials	9 Nov 1962	23 Nov 1962
5	General Design	22 Apr 1963	
6	Geology		
7	Real Estate		
8	Preliminary Master Plan		

CONANT BROOK DAM AND RESERVOIR

CONANT BROOK

CHICOPEE RIVER BASIN

MASSACHUSETTS

DESIGN MEMORANDUM NO. 5

GENERAL DESIGN

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CONANT BROOK DAM AND RESERVOIR
CONANT BROOK
CHICOPEE RIVER BASIN
MASSACHUSETTS

A. PERTINENT DATA

1. Purpose. Flood Control
2. Location of Dam.

State	Massachusetts
County	Hampden
Town	Monson
River	Conant Brook

Distance from:

So. Monson, Mass.	Approximately $1\frac{1}{2}$ miles
Mouth of Chicopee River	southeast 27.6 miles
3. Drainage Area. 7.8 square miles
4. Stream Flow.

Record of U.S.G.S. Gaging Station on the Quaboag River at West Brimfield, September 1912 to September 1961 (D.A. = 151 sq. mi.).

<u>Time</u>	<u>C.F.S.</u>	<u>C.F.S./Sq. Mi.</u>
Average annual	245	1.62
Maximum year (1938)	430	2.85
Minimum year (1930)	104	0.69
Maximum month (August 1955)	1440	9.54
Minimum month (October 1958)	11.9	0.1
Maximum day (August 19, 1955)	7590	50.26
Minimum day (several)	6.6	-

5. Maximum Floods of Record.

Record of U.S.G.S. Gaging Station, Quaboag River at West
Brimfield.

Peak Discharges

<u>Date</u>	<u>C.F.S.</u>	<u>C.F.S./Sq. Mi.</u>
August 19, 1955	12,800	84.8
September 21, 1938	8,470	56.1
March 19, 1936	3,620	24.0
March 12, 1936	2,040	13.5

Discharge at Monson Reservoir (Drainage Area = 8.0 sq. mi.).

<u>Date</u>	<u>C.F.S.</u>	<u>C.F.S./Sq. Mi.</u>
August 19, 1955	5,600 est.	700
September 21, 1938	1,230 est.	155

6. Reservoir Elevations, Areas, and Capacities.

Town affected - Monson, Massachusetts

Reservoir

<u>Location</u>	<u>Elevation</u>	<u>Area</u> <u>Acres</u>	<u>Storage</u> <u>Acre</u> <u>Feet</u>	<u>Inches on</u> <u>Dr. Area</u>
Spillway Crest	757.0	158	3740	9.0
Maximum Surcharge	766.0	212	5400	12.9
Top of Dam	771.0	254	6600	15.8

7. Criteria for Spillway Design Flood.

Total volume of rainfall, inches	24.4
Infiltration rate, inches per hour	0.05
Total volume of runoff, inches	23.2
Peak Inflow, c.f.s.	11,900
Maximum reservoir elevation, m.s.l.	766.0
Reservoir stage at start of flood, ft., m.s.l.	747.0
Duration of flood, days	2

8. Dam.

Type	Rolled filled earth and rock
Elev., top of dam	771.0
Length, feet	1,050.0
Maximum height, feet	85.0
Slopes	U/S 1 on 3 D/S 1 on 2.5
Top width, feet	20
Freeboard above spillway design flood, height, feet	5.0
Stream bed	Elevation 688+

9. Dike.

Type	Rolled earth fill with rock fill slope protection
Top elev. feet above m.s.l.	771.0
Top width, feet	32
Maximum height, feet	14
Total length, feet	980
Slopes	1 on 2.5 U/S & D/S

10. Spillway.

Type	Uncontrolled, concrete ogee weir and channel in rock
Crest length, feet	100
Crest elevation, feet m.s.l.	757.0
Maximum surcharge head, feet	9.0
Spillway design discharge, c.f.s.	11,000

11. Outlet Works.

a. Outlet Conduit.

Type	Precast Reinforced Concrete Pipe
Size of Conduit (dia.), feet	3
Invert Elevation, feet m.s.l.	694.0
Gates	None
Length, portal-portal, feet	405

11. Outlet Works (cont'd)

b. Outlet Capacity.

Reservoir discharge at
spillway crest, c.f.s. 225

12. Real Estate.

Total to be acquired, acres 390

13. Relocations.

Roads 1.3 miles, relocated
0.3 miles, new access

14. Utilities.

Water Works 2 wells
Telephone 2.4 miles
Electric 2.4 miles

15. Principal Quantities.

Excavation, Rock 54,000 cubic yards
Earth 103,000 cubic yards
Borrow 220,000 cubic yards
Embankment, Rockfill
& Slope Protection 58,000 cubic yards
Earthfill 263,000 cubic yards
Concrete 825 cubic yards
Cement 1,230 bbls.
R.C. Pipe, 3 ft. dia. 405 lf.
Gravel Bedding 23,000 cubic yards

16. Estimated Project Costs.

Lands and Damages \$ 106,000
Relocations, Hwy.-Water
& Power 701,000
Dam & Dikes 1,031,000
Access Roads
Preauthorization Studies 20,000
Engineering & Design 247,000
Supervision & Administration 150,000

Total \$2,255,000

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

FLOOD CONTROL PROJECT

CONANT BROOK DAM AND RESERVOIR

CONANT BROOK
CHICOPEE RIVER BASIN
MASSACHUSETTS

DESIGN MEMORANDUM NO. 5

GENERAL DESIGN

B. INTRODUCTION

1. Purpose. - The purpose of this memorandum is to set forth the general plan for the Conant Brook Dam and Reservoir and facilitate the review of detailed design memoranda, plans and specifications.

2. Scope. - This memorandum presents general data for the entire project. The data contained herein will be revised and expanded, as required, by supplement to this memorandum and by subsequent design memoranda. The section on Relocations is complete. No separate Design Memoranda on this section will be prepared.

C. AUTHORIZATION

3. Congressional Action. - The flood protection plan for the Chicopee River Basin was authorized in the Flood Control Act of 1960, July 14, Public Law 86-645.

In House Document 434, 86th Congress, the Chief of Engineers recommended "the further improvement of Chicopee River, Massachusetts, in the Connecticut River Basin by the construction of:

Conant Brook Dam and Reservoir for flood control, about two miles southeast of Monson, Massachusetts; generally in accordance with the plan of the Division Engineer and with such modification thereof as in the discretion of the Chief of Engineers may be advisable; at an estimated cost to the United States of \$2,080,000 for the construction, including a lump sum payment to the Town of Monson equal to the estimated increase in annual costs of the Town's water supply system resulting annually for maintenance and operation; provided that local interests prohibit the further obstruction of the floodway along Conant Brook in the Town of Monson."

D. INVESTIGATIONS

4. Previous Investigations. - An Interim Report on Review of Survey for Flood Control, Connecticut River Basin, Chicopee River Basin, Massachusetts was submitted by the Division Engineer on 8 September 1959 pursuant to authority contained in resolution of the Senate Public Works Committee adopted 14 September 1955. This report was printed in 1960 in House Document No. 434, 86th Congress, 2nd Session and included the recommendation for the construction of Conant Brook Dam and Reservoir.

5. Current Investigations. - a. New photogrammetric maps of the reservoir area and topographic surveys of the dam site and borrow areas have been made.

b. Previously obtained subsurface information has been reviewed and additional geological, soil investigations and explorations made.

c. Hydrologic studies have been reviewed. A new area capacity curve based on the photogrammetric survey was made and the spillway elevation was redetermined.

d. Appraisals of land damages to improvements in the reservoir and work areas have been undertaken.

e. Preliminary studies of affected roads are complete. Relocation of roads within the reservoir has been discussed with Town and County officials.

f. Relocation of Utilities has been discussed with the owners and preliminary studies are being prepared.

g. Water Supply - Investigations are under way to determine a suitable supply to replace the existing municipal wells in the reservoir area.

6. Coordination with Other Federal and Non-Federal Agencies. -

a. Federal Power Commission. - During the preparation of the interim report of September 1959, the Federal Power Commission reviewed a Memorandum Report on Power Study, Conant Brook Dam, prepared by the Division Engineer, New England Division, and concurred in the finding that the multiple-purpose development of the Conant Brook site for power and flood control was not economically feasible.

b. U.S. Department of Health, Education and Welfare. - The U.S. Department of Health, Education and Welfare believes that no major vector problems will be created as a result of construction of the Conant Brook Reservoir, but for public health safeguards against vector mosquito production, the following recommendations were made:

- (1) That borrow areas be graded to drain.
- (2) That floatage, secondary growth, and/or aquatic vegetation be removed after impoundment.
- (3) That inspection be made during the post project period to determine the mosquito breeding potential and, if necessary, to effect corrective measures.

The above recommendations will be carried out during the construction and post construction period.

c. U.S. Fish and Wildlife Service. - The U.S. Fish and Wildlife Service has investigated the effect of the project upon fish and wildlife resources of the area and a report has been submitted which is included as Exhibit No. 1 of this Memorandum.

d. U.S. Department of Commerce. - Bureau of Public Roads has advised that none of the Federal and primary or secondary routes contemplate the use of the dam as a highway bridge.

Department of Public Works, Commonwealth of Massachusetts, has stated that no future state highways are planned that would in any way affect the Conant Brook Dam or Reservoir and that no state highways would be affected by the project (Exhibit No. 3).

e. Commonwealth of Massachusetts. - The Water Resources Commission has reviewed the plans of the recommended project and examined the proposed Conant Brook Reservoir area to determine if it should be developed for recreational purposes. As a result of these examinations, the Massachusetts Department of Natural Resources and Massachusetts Division of Fisheries and Game have indicated to the Water Resources Commission that their Departments are not interested in any recreational development in the proposed reservoir area. (See Exhibit No. 4).

f. Town of Monson. - The views of the Town of Monson with respect to dam site and road relocations, and water supply were obtained from Town officials at several informal meetings. The officials have requested that a recreation pool be incorporated in the design since there are no local recreation areas in the vicinity. This request is being studied. (See Exhibit No. 5, 6, & 7).

7. Existing Improvements by Other Federal Agencies. - There are no existing specific flood control improvements by other Federal agencies in the reservoir area.

E. LOCAL COOPERATION

8. Local Cooperation. - The cost of constructing a flood control reservoir at the Conant Brook site will be wholly Federal since the benefits are solely for flood control at downstream damage centers along Chicopee Brook and the Quaboag and Chicopee Rivers.

Officials of the Town of Monson have given written assurance that they favor the construction of Conant Brook Reservoir and that they will give complete cooperation to bring the project to conclusion.

9. Flood Plain Encroachments. - The authorization for the Conant Brook Dam and Reservoir requires that "local interests prohibit the further obstruction of the floodway along Conant and Chicopee Brooks in the Town of Monson". To comply with this requirement, the Water Resources Commission of the Commonwealth of Massachusetts intends to establish a restricted floodway with a discharge capacity comparable to a 50-year flood. It is anticipated that the Town of Monson will establish flood plain restrictions in the area above the floodway and to the limits of flooding experienced in the record flood of August 1955. Under the authority of Section 206, Public Law 86-645, a Flood Plain Information Report is being prepared to assist the local interests in establishing the necessary criteria.

F. LOCATION OF PROJECT

10. Location of Project. - The Conant Brook Reservoir site is located in the south central part of Massachusetts in the Town of Monson. The dam site, across Conant Brook, is about two miles southeast of the community of Monson, Massachusetts. (See Basin Map, Plate No. 5-1 and Reservoir Map, Plate No. 5-2).

11. Access to Site. - The site is accessible from Monson via hard-surfaced roads. A 20-foot paved access road to Blanchard Road will be provided.

12. Railroad Facilities. - The Central Vermont Railroad serves Palmer and Monson, Massachusetts, with an unattended station at Monson and an agent at Palmer.

13. Description of the Chicopee River Basin. - The Basin of the Chicopee River, a tributary of the Connecticut River, lies entirely in Central Massachusetts. The watershed is approximately 28 miles in length and an average of 26 miles in width. It has a total drainage area of 721 square miles. Much of the topography consists of rolling wooded hills. Basin elevations range from 40 feet at the mouth of the Chicopee River to over 1720 feet on the northeastern section of the watershed, as shown on the Basin Map, Plate No. 5-1. The Chicopee River has three major tributaries, the Swift, Ware, and Quaboag Rivers. The confluence of these streams forms the Chicopee River. Conant Brook joins the Quaboag River at Palmer, Massachusetts.

G. RECOMMENDED PROJECT PLAN

14. Recommended Project Plan. - The recommended project plan included the construction of a dam, combined rolled earth fill and rock fill construction, about 1235 feet long, with a maximum height of about 85 feet above streambed elevation.

a. A concrete ogee overflow spillway, 125 feet long, and a spillway channel located on right bank.

b. The outlet for discharge flood storage consisted of a single ungated 48-inch diameter conduit with trash rack to prevent clogging.

c. Two wells, which are an important source of water supply for the Town of Monson, are in the Conant Brook Reservoir area and would be relocated.

d. Relocation of Wales Road owned by the Town of Monson.

e. A 24-inch high pressure gas line would be anchored in place.

H. DEPARTURE FROM PROJECT DOCUMENT PLAN

15. Departure from Project Document Plan. - The following modifications and changes from the approved document have been made during the development of detailed studies.

a. The spillway crest elevation has been raised from elevation 754.0 to elevation 757.0 mean sea level. This change is based on new photogrammetric maps. (See Area Capacity Curves, Plate No. 5-14, and Hydrology and Hydraulics Design Memorandum No. 1).

b. A 100-foot spillway with 9-foot surcharge has been adopted as a result of economic studies based on surcharge versus spillway lengths and on the revised alignment of the dam.

c. The alignment was adjusted by moving the right end 100 feet downstream to obtain better rock foundations for the spillway weir and walls and because of more satisfactory earth foundations under the embankment. Based on recent similar design using similar materials, the downstream slope has been tentatively changed to 1 vertical to 2.5 horizontal and a combination of foundation cutoff and relief wells will be provided instead of an upstream blanket. Top width of the dam has been reduced from 25 to 20 feet. The embankment has been modified on the basis of recent similar designs.

d. Reservoir clearing will not be accomplished since a permanent pool is not proposed at this time.

I. HYDROLOGY

16. Reservoir Capacity. - The authorized reservoir capacity of 9.0 inches has been reviewed and adopted. Discussion of reservoir capacity is included in Design Memorandum No. 1, Hydrology & Hydraulics.

17. Spillway Design Flood. - For spillway design purposes a flood was developed based on the probable maximum precipitation over the watershed falling on ground saturated from previous rains.

The total rainfall amounts to 24.4 inches in 24 hours with 19.2 inches occurring in a six-hour period. Losses are assumed at the rate of 0.05 inches per hour, resulting in rainfall excess of 23.2 inches. The adopted spillway design flood with a peak inflow of 11,900 cubic feet per second was developed by applying the rainfall excess to the adopted unit hydrograph for the 7.8 square miles of drainage area above the dam site. Routing the flood through the reservoir, assuming that (a) the reservoir had six inches of storage utilized and (b) the ungated outlet was operative, resulted in a maximum surcharge elevation of 766.0 feet, m.s.l. and a total peak discharge of 11,000 c.f.s.

18. Freeboard. - A freeboard of five feet above the maximum surcharge pool elevation of 766.0 is provided resulting in a top of dam elevation of 771.0 feet, m.s.l.

19. Channel Capacity. - The channel capacity of Chicopee Brook through North Monson (D.A. = 17 to 21 sq. mi.) is estimated to be between 400 to 500 c.f.s.

20. Outlet Capacity. - The selected outlet for Conant Brook will consist of an ungated 36-inch reinforced concrete pipe conduit. With the reservoir about 60 percent full, the discharge through the conduit will be about 200 c.f.s. This capacity will be sufficiently restrictive to effectively use the reservoir storage, yet large enough to empty the reservoir within a reasonable time. The discharge capacity will also satisfy diversion requirements.

J. GEOLOGY

21. General. - Conant Brook and its tributaries drain an area of moderate relief located in the western part of the Worcester Plateau. The surface of this area lies generally between elevations 500 and 1000 feet and is characterized by broad, steep-sided hills and poorly drained valleys. The topography is controlled largely by the underlying, complexly folded and much altered crystalline bedrocks, the surfaces of which have been modified by glacial and post-glacial erosion and deposition. Remnants of glacial outwash and lake deposits are present in the floor and along the sides of the main valleys. Above these deposits, the slopes are blanketed with glacial till through which bedrock outcrops rather extensively at the higher elevations. Limited exposures of bedrock are also present locally in and along the floors of some of the valleys where streams, in their meanderings and down-cutting, have completely removed the overburden materials.

22. Dam Site. - In the site area Conant Brook is flowing in a narrow valley, the slopes of which rise abruptly from a small flood plain. The left or south abutment is formed by a large till and bedrock hill. Bedrock is exposed high on the east flank of the hill but in the abutment area is overlain by a thick deposit of till. The till is generally sandy consisting principally of silty, gravelly sand and silty sand, with cobbles and boulders, and including layers of silt and clay. The feature forming the right or north abutment is controlled by bedrock, overlain by a mantle of till or till-like materials. The rock outcrops locally above elevation 750 feet, and in the river bank some 350 feet downstream of the project centerline. Elsewhere on the right abutment the rock surface is available at shallow depths for founding spillway and conduit structures, and excavations for the spillway channel will be principally in rock. The bedrock is a locally granitized, biotite schist, the structure of which trends normal to the river and has a near vertical dip. In general, the top 10 to 15 feet of the rock is highly jointed and fractured, and variably weathered. This condition, and water losses recorded during hydraulic pressure testing, indicate a need for seepage control in this zone. In the floor of the valley the bedrock is overlain by up to 40 feet of overburden consisting of till, overlain by outwash deposits, capped by recent alluvium. Layers of silt and silty fine sand are common to all of these deposits; however, the bulk of the materials in the stream section consist of variably silty, sands and gravels, with zones of relatively clean and somewhat pervious materials.

The vertical distribution of overburden materials and bedrock in the valley floor and abutments along the survey report baseline indicated on Plate No. 5-4, is shown in Geologic Section on Plate No. 5-5. Explorations are in progress to further delineate a source of random and impervious materials, and to detail the position and condition of rock in relation to the spillway and outlet works.

23. Dike Site. - The low dike is located in the area where Munn Road crosses the reservoir, about a mile north of the dam. The valley floor is occupied by a swamp, along the brook, flanked by remnants of glacial outwash. In the outwash remnants abutting the swamp, the sands and gravels are variably silty and compact, while in the swampy area they are generally clean and pervious at least to an explored depth of 30 feet and are capped by several feet of organic silt.

K. DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

24. General. - The Conant Brook Dam will consist of a rock faced rolled earth fill embankment and dike; a chute spillway with a low ogee crest in rock in the right abutment of the dam and an ungated outlet works consisting of a 36-inch reinforced concrete pipe conduit on rock in the right abutment. Access to the top of the dam will be by means of a road from relocated Blanchard Road. Parking for a limited number of cars will be provided at the top of the dam.

25. Dam Embankment. - The dam embankment design is influenced by the foundation conditions and the availability and characteristics of embankment materials. The profile of the dam and a tentative embankment section are shown on Plate No. 5-7. Required earth excavations for the project will furnish a relatively small portion of the earth embankment materials needed for the dam. The bulk of these embankment materials will be obtained from a borrow area in a glacial till deposit located above the left abutment of the dam. The outside embankment slopes have been established tentatively on the basis of other designs using similar materials and with similar foundation conditions. The embankment section will be of the zoned type and will consist of zones of impervious, random, and pervious embankment materials. The locations, compositions, and dimensions of the zones will be established on the basis of the relative availability and characteristics of the various types of materials as determined by investigations now in progress. The embankment slopes, both upstream and downstream, will be protected by layers of rock and appropriate bedding materials. Complete foundation cutoff is not practicable. Unless it later proves practicable to obtain a complete cutoff in this reach, it is proposed to install about three relief wells and a foundation drain trench for the control of seepage passing under this reach of the cutoff. The embankment section will include a downstream drainage blanket and similar features as required for the adequate control of other seepage through the foundation and seepage through the embankment. Details of the embankment will be included in Design Memorandum No. 3, "Embankments and Foundations".

26. Dike Embankment. - The dike embankment design is influenced by the foundation conditions and the availability and characteristics of embankment materials. The profile of the dike and a tentative embankment section are shown on Plate No. 5-6. The dike will carry the relocated portion of Munn Road and its top width will be governed by road requirements. The dike embankment will be of the homogeneous

type except for drainage features and rock slope protection on both side slopes. A small impervious upstream blanket will be provided for the higher reach of the dike to control foundation seepage. Details of the embankment will be included in Design Memorandum No. 3, "Embankments and Foundations."

27. Spillway. - The spillway will be located in the right abutment and will be separated from the embankment by a concrete retaining wall. The spillway will be a chute channel type with an uncontrolled fixed crest trapezoidal weir having a crest length of 100 feet and a crest elevation of 757 feet, m.s.l. The rock side walls will be faced with a 12-inch thickness of concrete. (See Plate No. 5-10).

28. Outlet Works. - The outlet works will be located on the right bank of the river under the dam and will be founded on rock. (See Plate No. 5-8). The inlet channel will be excavated in earth and rock with a bottom width of 10 feet. The discharge channel will return the flow to the river through the lower end of the spillway channel. No stilling basin will be provided. A structural steel trash rack will be provided at the inlet structure. Details of the outlet works will be more fully developed in Design Memorandum No. 2, "Detailed Design of Structures".

29. Log Boom. - A log boom will be installed at the approach to the outlet works to screen logs and other heavy debris. End anchorage will be installed at Elevation 762.0 to piling by boom chains and boom cable. The logs will be connected end to end by passing boom chains through bored holes and whole assembly reinforced by threading 3/4-inch wire rope boom cable through the rings of the boom chains.

30. Staff and Recording Gages. - A series of staff gages and a recording gage of the bubbler type will be provided for reading and recording reservoir stages. The bubbler gage recorder will be housed in a concrete structure located on top of the dam.

31. Administration Facilities and Utilities. - No administration facilities or utilities are provided. It is expected that maintenance and operation will be accomplished by a mobile group operating from nearby dams.

32. Use of Consultants. - The Conant Brook Dam imposes no complex design problems; therefore, no consultants were used.

L. SOURCES OF CONSTRUCTION MATERIALS

33. Embankment Materials. - Random and impervious materials for construction of the major portion of the earth embankments of the dam and dike will be obtained from a borrow area to be established on the left abutment above the top of dam. The material in this area is a compact to very compact, sandy glacial till containing numerous cobbles. The top 5-10 feet is particularly sandy consisting principally of silty medium to fine sand and gravelly silty sand.

Pervious and select pervious materials for drainage and bedding purposes will be furnished by the contractor. Adequate supplies of these materials are available from commercial, non-operative and undeveloped sources within a 2-15-mile haul radius of the project.

34. Rock Materials. - Sound durable rock, suitable for use as dumped rock fill or slope protection, will be obtained with some selection from required rock excavations.

35. Concrete Aggregate. - Materials suitable for use as concrete aggregate are available from a number of approved commercial sources within a 15-mile haul radius of the project. Complete test data on materials sampled are contained in Design Memorandum No. 4, "Concrete Aggregates", dated November 1962 and approved 23 November 1962.

M. REAL ESTATE

36. General. - The acquisition program for Conant Brook Reservoir will be made in accordance with the regulations set forth in EM 405-2-150 dated 1 October 1958, as amended 9 March 1962, Real Estate Planning and Project Authorization, Civil Works Projects.

This report is based on alternate studies as follows:

a. Premise #1. - Based on Spillway Crest Elevation 757' m.s.l. and designed for the purpose of flood control.

b. Premise #2. - Based on Spillway Crest Elevation 761' m.s.l. and designed for the dual purpose of flood control and water supply. (See Paragraph 55).

37. Land Requirements. a. Premise #1. - The minimum guide-taking line has been established at 300' horizontally from full static pool elevation 757' m.s.l. The total estimated acreage is 390 acres, which includes all lands required for the dam site, work area, borrow and reservoir areas and also for road relocations.

b. Premise #2. - The minimum guide-taking line has been established at 300' horizontally from full static pool elevation 761' m.s.l. The total estimated acreage is 430 acres, which includes all lands required for the dam site, work area, borrow and reservoir areas and also for road relocations.

The actual property acquisition line cannot be accurately estimated at this time due to the lack of detailed property maps and adequate tract data.

The total estimated acreages may be further increased by future requirements for fish, wildlife and for recreational purposes; or by the normal real estate practice of acquiring properties in entirety where access will be denied or severance damage to remainders equals the value of such remainders.

Specific exceptions to the standard land acquisition policy are presented and approval will be requested.

38. Description of Reservoir Area. - The Conant Brook Reservoir is located wholly in the Town of Monson. The center line of the dam is located about two miles southeasterly of the center of town, on Wales Road on the Conant Brook, at a point along the upper reaches of the Monson Reservoir which is used only as an emergency water supply system.

From the proposed dam, the reservoir will be contained by a series of wooded hillsides which forms an irregular-shaped basin; and extends in a southerly direction to Moulton Hill Road and northerly to Munn Road.

Except for a rather densely built up area along Wales Road just below the proposed project, the reservoir will be in a primarily rural area. The terrain is rolling with medium to rather steep slopes on each side of the waterways. Most of the valley is wooded with a small portion devoted to agriculture. Just upstream from the dam site is a well field owned by the Town and used as an underground water supply system. Near the junction of Vinica Brook and Wales Road the Tennessee Gas Pipeline Company pipeline crosses the middle of the reservoir but no relocation or weighting is necessary.

Within the reservoir area there is a new small summer residence, a rural residence, an actively operated dairy farm, a good-sized stock farm and the Moulton Hill Cemetery. The latter four properties are located within the 300' horizontal peripheral strip immediately adjacent to spillway crest elevations.

39. Evaluation. a. Premise #1. - The estimated real estate costs based on the acquisition of 390 acres of land including administrative and resettlement costs is \$106,000.

b. Premise #2. - The estimated real estate costs based on the acquisition of 430 acres of land including administrative and resettlement costs is \$108,500.

Under submission of the Real Estate Design Memorandum recommended exceptions to the standard land acquisition policy in the amount of approximately \$42,000 will be requested.

N. RELOCATIONS

40. General. - There are six local roads, all within the Town of Monson, which are located within or cross the reservoir area. One road will be relocated outside the reservoir area and sections of two roads will be raised. The remaining roads and sections of roads within the reservoir area will be abandoned.

a. The Guide-Taking Line, for purposes of this Design Memorandum, has been established at Elevation 762.0, which is five feet above spillway crest elevation. Guide-Taking Line, as used herein, does not delineate the limits of land acquisition, which will be acquired in accordance with EM 405-2-150.

b. Roads to be raised or relocated will have a minimum profile grade of Elevation 762.0. Flowage easements will be obtained for all roadway embankments in the reservoir area below the Guide-Taking Line, Elevation 762.0, and embankments protected by rock fill laid on gravel bedding, where required.

c. Three turnarounds will be constructed to permit snow removal and maintenance equipment, fire apparatus and school buses to reverse direction at locations where Wales Road, East Hill Road and Waterworks Road enter the reservoir area.

d. There are no public buildings located within the reservoir area. The Moulton Hill Cemetery is located within the 300' horizontal peripheral strip immediately adjacent to spillway crest elevation.

41. Identification. - Each road or section of road within or adjacent to the reservoir area, where some modification will be required, is identified by a number which is shown on Plate No. 5-12 and corresponds to the description in this memorandum bearing the same identification number.

42. Traffic Counts. - Traffic counts, which are shown in the pertinent paragraphs of this memorandum, were taken in October 1962 by the Massachusetts Department of Public Works and are considered to be representative at the present time.

43. Relocation Agreement - Type of Contract. - Officials of the Town of Monson have advised that they prefer to have the Government acquire all land required, perform all engineering services, award and supervise the construction contracts for all road relocations required by the flood control project. The Hampden County Commissioners concur in the above request. A cost reimbursable contract will be negotiated with the Town of Monson and County of Hampden which will cover all required road modifications and provide for reimbursement to the Town and County for necessary legal expenses incurred in the abandonment of existing roads and acceptance of the relocated roads. All highway relocations or modifications will be performed by the Government at its expense.

44. Local Roads. a. Wales Road. - Wales Road is under the jurisdiction of Hampden County and is operated and maintained by the Town of Monson. This is the most heavily travelled highway within the reservoir area with an ADT volume of 460 vehicles. It is the only improved highway connecting the Towns of Monson and Wales. This road was widened and improved during the period 1933-1937 by adding a two-inch road mix surface for a width of 20 feet, which is maintained in very good condition. The gravel shoulders are of variable width, usually averaging 3-4 feet. A section of this road within the reservoir area, about 2700 feet in length, which crosses the dam site, as shown on Plate No. 5-12, Identification No. 3, will be abandoned.

A replacement road will be constructed around the south and west sides of the reservoir area, utilizing a section of Blanchard Road, as shown on Plate No. 5-12, Identification Nos. 1, 2 and 4. A turnaround will be constructed below the dam, as shown on Plate No. 5-12, Identification No. 13.

Photogrammetric maps were studied and cost estimates prepared to determine the most economical location for the relocated highway, consistent with modern design standards, and the use of existing roads, where practicable. It is not feasible to shorten the length of the relocation on the westerly end because of excessive real estate damage and the sharp rise in terrain south of Moores Cross Road. The alignment selected at the easterly end of the relocation will avoid the unsatisfactory horizontal and vertical alignment of Blanchard Road and also avoid extensive damage to a valuable stock farm located on the easterly side of Moulton Hill Road. The 12'-14' gravel road, located south of the Moulton Hill Cemetery, Old Wales Road, will be replaced by the relocated Wales Road.

The replacement road will be constructed for a total distance of about 9300', including the improvement of about 3000' of Blanchard Road, substantially in accordance with design criteria used by the Massachusetts Department of Public Works for a section of Wales Road, east of its intersection with Route 32, which was reconstructed in 1961, inasmuch as there are no published design standards in Massachusetts. This section was constructed of a $2\frac{1}{2}$ " bituminous concrete over 12" gravel base for a width of 26 feet, without shoulders as this is a residential area. It is proposed that the replacement road be paved for a width of 24' with $2\frac{1}{2}$ " bituminous concrete over 12" gravel base with 3' gravel shoulders on each side.

A reinforced concrete culvert, with twin boxes 9'x10', will be constructed to carry Conant Brook beneath the relocated section of Wales Road below the proposed dam. The combined waterway opening of 180 square feet is more than adequate to pass the August 1955 flood of record with Conant Brook Dam in operation.

A small 4'x4' box culvert will be constructed to carry an unnamed brook beneath the relocated section of Wales Road east of the junction where it leaves Blanchard Road. The present culvert which carries this brook under Blanchard Road is a metal pipe arch 42"x48".

A reinforced concrete culvert, with twin boxes 10'x12', will be constructed to carry Vinica Brook beneath the relocated section of Wales Road west of Moulton Hill Road. The multi-plate metal arch bridge, with a clear width of 21 feet and height of 12 feet from top of arch to streambed, beneath Moulton Hill Road was adequate to pass the August 1955 flood of record, except for a short period during which only a few inches of water flowed across the road.

b. East Hill Road. - East Hill Road is a local town road serving mostly residents of the area and has an ADT volume of 40 vehicles. The 16'-18' bituminous treated gravel pavement, with variable width gravel shoulders, is maintained in good condition. About 2400' of the existing road is within the reservoir area, as shown on Plate No. 5-12, Identification No. 5, and will be abandoned and a turnaround constructed where it enters the reservoir area, as shown on Plate No. 5-12, Identification No. 8.

c. Munn Road. - Munn Road is a town road which connects several of the lightly travelled country roads in the sparsely settled areas with the main roads and has an ADT volume of 58 vehicles. The 16'-17' wide bituminous treated gravel pavement, with 4' wide gravel shoulders is maintained in good condition. A section of this road, about 975 feet in length, as shown on Plate No. 5-12, Identification No. 10, will be raised as a dike to close off a saddle in the upper reaches of the reservoir. The roadway surface of the raised section will be constructed of bituminous treated gravel 20 feet wide with 3' gravel shoulders on each side. Construction details for the dike, including the raised section of the road, are shown on Plate No. 5-6 and estimated cost included in Table No. I.

d. Sutcliffe Road. - Sutcliffe Road is a 12' gravel town road maintained in good condition with an estimated traffic volume of less than 25 vehicles per day. Its approach to Munn Road will be raised for a distance of about 220 feet, as shown on Plate No. 5-12, Identification No. 11, to meet the raised grade of the dike. The raised section will be constructed of gravel 18' wide. The cost of raising this approach is also included with the cost of the dike.

e. Pond Road. - Pond Road is a 12'-14' gravel road which is maintained by the Town of Monson. A section about 1500' in length, as shown on Plate No. 5-12, Identification No. 7, is below the Guide-Taking Line and will be abandoned as the ADT volume on this road is only eight vehicles. A section of the road to be abandoned, about 825' in length, is under the jurisdiction of Hampden County.

f. Waterworks Road. - Waterworks Road is a 12' gravel town road maintained in fair condition which has an ADT volume of 20 vehicles. A section of this road, about 1400' in length, as shown on Plate No. 5-12, Identification No. 6, is below the Guide-Taking Line and will be abandoned. A turnaround will be constructed at the edge of the reservoir area, as shown on Plate No. 5-12, Identification No. 9.

g. Blanchard Road. - Blanchard Road is a 14'-16' bituminous treated gravel town road, south of Moores Cross Road, which is maintained in good condition. The section north of Moores Cross Road is gravel, about 10' wide, and is maintained in fair condition. A section about 3000' in length, as shown on Plate No. 5-12, Identification No. 2, will be improved and used as part of the relocation of Wales Road and reconstructed to the same design standards.

45. Access Road. - An access road to the dam, about 1700' in length, will be constructed from Blanchard Road, as shown on Plate No. 5-12, Identification No. 12. This road will be constructed of 2½" bituminous concrete pavement over 12" gravel base, 20" wide, with 4' gravel shoulders on each side. The estimated cost of the access road is included in Table No. VI, page 30.

46. Mail and School Bus Routes. - Children living within the vicinity of the reservoir area are all transported by school bus to schools in the Town center. The bus routes presently traverse sections of Wales Road, East Hill Road and Waterworks Road within the reservoir area. Studies have been made to reroute the school buses around the reservoir area which show that a saving in travel distance of about 4 miles a day can be made over the present routing.

Mail is delivered by rural free delivery over all roads except Pond Road and Waterworks Road within the reservoir area, from the central post office in Monson. Studies show that by changing the routing around the reservoir area, a small decrease in travel distance can be realized.

47. Design Criteria. a. The Commonwealth of Massachusetts Department of Public Works does not have published design standards for local roads and therefore the design criteria for Wales Road relocation is based upon the design used in reconstructing a section of Wales Road in 1961, as explained in Paragraph 44a. The short section of Munn Road, which will be used as a dike and raised, will be constructed wider than the present road because it is a structure required by the reservoir and the expense of widening at a later date would be excessive.

Relocated roadway embankments below the Guide-Taking Line, Elevation 762.0, will be protected by placing rock fill or riprap, with a minimum thickness of 2 feet over gravel bedding 1-foot thick.

b. Culverts will be designed for H20-S16-44 loadings.

The 3-52" ACCM pipe culverts which carry Conant Brook beneath East Hill Road will be left in place.

c. The steel stringer bridge with reinforced concrete deck on Wales Road crossing Conant Brook below the proposed dam will be retained. The concrete abutments and wing walls are in good condition but there is some spalling of the parapet walls. The clear waterway opening of 23.8' wide and 12' deep is adequate to pass the August 1955 flood of record.

Detailed criteria used in the design of major drainage structures will be submitted after the contract plans have been prepared and are submitted for approval.

48. Cost Estimates. - The estimated costs of all road relocations and modifications were computed from aerial survey maps, scale 1" = 200' and 5-foot contour interval, as follows:

TABLE I
Highway Relocations

<u>Road</u>	<u>Estimated Construction Cost</u>
Wales Road, Relocation	\$300,000
Turnarounds (3)	1,500
Land Damages	<u>7,500</u>
Total	\$309,000

The above estimates are based on average unit prices which have been bid on similar types of projects in the Commonwealth of Massachusetts during 1961-1962 and include 15% for contingencies. Indirect costs for engineering, supervision and administration are not included. The estimated cost of the Access Road to the dam and the raising of Munn Road and approach to Sutcliffe Road are included in the cost of the dam and dike, respectively, and are not included in the above figures.

49. Allocation of Costs. - The cost of all highway relocations and modifications, as described herein, will be borne by the Government.

50. Attitude of Local Officials. - The plans for proposed highway relocations and modifications, as described herein, have been reviewed with the Selectmen of the Town of Monson and Hampden County Commissioners, who have indicated informally that they are in agreement with the proposed plans.

51. Utilities - General. - In preparation of the utilities relocations plan, it has been assumed that no electric or telephone service will be required in the reservoir area. Estimates of Government cost are based on cost of new work, original and reproduction cost, depreciation, removal cost and salvage, with necessary adjustment incident to joint ownership of poles. The work will be accomplished by the owners under relocation agreements and will be coordinated with other work in the reservoir area. All electric and telephone lines in the reservoir area are on pole lines and are jointly owned by the Massachusetts Electric Company and the New England Telephone and Telegraph Company.

52. Massachusetts Electric Company. a. General. - All electric lines in the reservoir area are owned by the Massachusetts Electric Company. On Munn Road, there are three poles, supporting a single phase 2,400 volt line, which must be relocated. On Wales Road, from Moores Cross Road to Waterworks Road, there is a 3 phase, 2,400 volt line. This line will be relocated around the reservoir area on Blanchard Road. This relocation will involve approximately 2.1 miles of new pole line construction and approximately .3 miles of reconstruction of existing pole line. There will be one abandonment of a secondary service to a camp in the reservoir area. No betterments will be involved in these electric relocations.

TABLE II

b. Estimate of Costs. -

(1) Abandonment

A. Original cost	\$129
B. Depreciation	19
C. Removal	73
D. Salvage	58

Cost to Government

$$A - B + C - D = \$125$$

TABLE II (cont'd)

(2) Relocations

A.	Present day replacement cost	\$ 6,212
B.	Depreciation	3,727
C.	Removal	1,953
D.	Salvage	175
E.	New Work	12,467

Cost to Government

$$E - B + C - D = \$10,518$$

(Note: In accordance with the practice of the two utilities involved concerning joint ownership of poles, wherein the utility having custody of the poles claims full cost of installation, removal and salvage of joint plant, all such costs in this report are allocated to the Massachusetts Electric Company as it has custody of all joint plant involved in these relocations).

53. New England Telephone and Telegraph Company. a. General. - All telephone lines in the reservoir area are owned by the New England Telephone and Telegraph Company. On Munn Road, a telephone cable will require relocation for three pole spans. On Wales Road, from Moores Cross Road to Waterworks Road, there is a 51 pair cable that will be relocated around the reservoir area on Blanchard Road. This relocation will involve approximately 2.1 miles of new pole line construction and approximately .3 miles of reconstruction of existing pole line. There will be no abandonments. No betterments will be involved in these relocations.

TABLE III

b. Estimate of Costs. -

(1) Relocations

A.	Present day replacement cost	\$2,936
B.	Depreciation	438
C.	Removal	775
D.	Salvage	58
E.	New Work	3,937

Cost to Government

$$E - B + C - D = \$4,216$$

54. Summary of Estimated Cost to Government. -

Massachusetts Electric Company	- Abandonment - \$	125
Massachusetts Electric Company	- Relocations -	10,518
New England Telephone & Telegraph Co.	- Relocations -	<u>4,216</u>
		\$14,759
	Contingencies - 15%	<u>2,221</u>
	TOTAL	\$16,980

55. Water Supply - General. - Two of the three wells from which the Town of Monson derives its municipal water supply are located in the Conant Brook Reservoir and will be subject to inundation. The ground at the wells is at Elevation 700 m.s.l. The wells, which are large, granite-walled, dug wells about 25 feet deep with roofs, derive their water from the ground and from two small streams which are diverted into the wells when the water is free from turbulence. The estimated yield from the two wells, including the diverted water from the brook, is 550,000 gallons per day. Immediately downstream from the Conant Brook dam site there is a small dam which impounds some three million gallons of water which can be introduced into the Town water system in an emergency. The third well which the Town uses is in the north end of the Town's business section. This well is a gravel-packed well with a safe yield of 300 gpm and a peak yield of 500 gpm. There are three other wells in the business section of Monson which are privately owned. These have yields of 500 gpm, 500 gpm and 300 gpm but this water is not available as a source of water for the Town.

The Water Department of the Town has requested a replacement supply of 530,000 gallons per day and storage of one million gallons between Elevation 675 and Elevation 700. Their storage replacement is claimed on the basis that they presently have space within the dug wells which could act as reservoirs. As stated above, these are very large. The rectangular one is 60 ft. x 30 ft. x 25 feet deep with an 8-inch outlet 6 feet above the bottom. The circular well is 75 feet in diameter and 25 feet deep. The outlet is 8 feet above the bottom but a down-turned tail pipe extends to within 2 feet of the bottom permitting siphon action to that point. Storage volume calculated on that basis amounts to slightly more than one million gallons. It should be noted that the Town Water Commissioners originally claimed only 550,000 gallons of storage predicated on the usual water levels in the wells and, after reconsidering the situation, claimed the higher amount. Detail of the existing system will be included in a supplement to this Design Memorandum. (For location see Plate No. 5-13).

56. Source of Replacement. - The source of a replacement water supply is not yet determined. Explorations for possible wells have been made by this office through the valley in the Town and one or more sites are being tested. If a suitable location acceptable to the Town can be found, a relocation agreement can be negotiated on the basis of wells. If wells are not feasible, it will be necessary to provide a permanent pool for water supply within the reservoir in which case the Massachusetts Department of Health will require the Town to treat the water before it enters the water distribution system. A supplement to the General Design Memorandum on the subject replacement water supply will be submitted later.

57. Estimate of Cost. - Estimate of cost for a replacement water supply from wells is listed below. Pending results of well tests it has been assumed that three wells with pumps, houses and appurtenances will be required to produce an acceptable supply for the Town. Land and exploration costs have not been included. Cost of engineering, supervision and administration are excluded from the estimate.

TABLE IV

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
Pump Houses	3	each	4,000	\$ 12,000
Equipment	3	each	14,000	42,000
Wells	3	each	8,000	24,000
Venturi Meter & Recorders	3	each	4,000	12,000
Access Roads	1	Job	L.S.	4,000
Standpipe	1	Job	L.S.	78,500
Connecting Pipe	1	Job	L.S.	12,300
Electrical	1	Job	L.S.	10,000
Telemetry	1	Job	L.S.	1,200
Sub-Total				\$196,000
Contingencies 20%				39,000
Total				\$235,000

58. Additional Cost of Operation. - The Town of Monson will incur an increased cost of operation and maintenance for the replacement water supply. It is proposed to pay the Town the capitalized value of the increased cost amounting to \$140,000, as estimated below. Pending the completion of design studies the estimate contained in the Interim Report is retained as follows:

Major replacement of electrical pump and misc. supplies
 (\$20,000) x 0.4231 x 0.04263 \$ 360
 (Supplies would be replaced 25 yrs. at an interest
 rate of 3.5% amortized over a period of 50 yrs.)

Operating pumping cost 550,000 gals. per day x 365 days
 at 3.7¢ per 1000 gals. 7,430

Maintenance, labor and supplies 1,680

Total annual cost \$ 9,470

Actual annual operating, maintenance and major
 replacement cost for existing wells
 additional recurring annual cost - 3,500
 5,970

Capitalized value of \$5,970 at 3.5% int. over
 50 yrs. as basis for repayment

\$5,970 ÷ 0.04263 = 140,000

Total Capitalized Value \$140,000

59. Alternative Water Supply Replacement. - The alternative method of supplying storage within the reservoir for a surface water supply requires the dam to be raised to retain the flood control storage effectiveness. The study was based on an average daily demand of 550,000 gallons without provisions for expansion. Stream flows on Conant Brook are not gaged so the runoff records for the Quinebaug River at Westville, Massachusetts were used as a guide. The terrain of the two basins are similar so the runoff characteristics are assumed to be similar. Rainfall records for Southbridge, Massachusetts were used. The water year from October 1956 to September 1957 was the driest one for the period of record from 1929 through 1957. Studies based on that year indicate 120 acre-feet of storage would be necessary for water supply. The Massachusetts Department of Public Health has indicated additional depth is required to prevent the water from becoming objectionably warm and polluted so a permanent pool at elevation 720.0 m.s.l. would be established for a water supply reservoir. There are 600 acre-feet of storage to that elevation. The Massachusetts Department of Public Health has also indicated it would be necessary to filter

the water prior to domestic use through a sand filter. The drainage area is composed principally of wooded, mountain area part of which is a State Forest and another section is a wildlife sanctuary. The area is clean and it appears a pressure sand filter would accomplish the desired treatment. For estimating purposes a treatment plant for 400 gpm composed of the following units has been assumed:

a. A concrete intake tower to a point 5 feet above the water supply pool. This would be inundated when flood control storage is used.

b. 12-inch supply main through the dam on a concrete cradle.

c. A booster pump in a concrete pit to pressurize the water supply to the filters.

d. A concrete block filter plant with 4 filters, a backwash tank and pump, chlorinators, heat, light and power.

e. A one million gallon standpipe with bottom at Elevation 675 and high water at Elevation 700.

The estimated costs for this system are as follows:

TABLE V

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
Intake Tower	1	Job	L.S.	\$ 26,000
Intake Pipe	1	Job	L.S.	10,000
Piping	4,400	L.F.	\$9.00	39,600
Filter Building	1	Job	L.S.	20,000
Equipment	1	Job	L.S.	56,500
Standpipe	1	Job	L.S.	78,500
Access Road	1	Job	L.S.	7,000
Electrical	1	Job	L.S.	5,000
Sub-Total				<u>\$242,600</u>
Contingencies				<u>48,400</u>
				<u>\$291,000</u>
Raising dam 4 feet				<u>190,000</u>
			Total	<u>\$481,000</u>

60. Surface Water Supply. - The Town has not been consulted concerning a surface water supply. A standpipe is included in the above estimate but will not be included in the final estimate unless the Town system cannot function without it. The capacity of the filters is adequate to pass the required flow with one filter being backwashed and this should constitute an equitable replacement for the two wells.

61. Cost Estimates. a. The total cost of the Conant Brook Reservoir Project is \$2,255,000, which is an increase of \$175,000 over the figure contained in the interim report.

b. The major changes involved are:

(1) Lands and Damages. - The cost of \$25,000 is increased to \$106,000. This is due to the fact that a new acquisition policy is in effect. However, exceptions will be asked and presented in detail in the Real Estate Design Memorandum.

(2) Dam and Access Road. - The cost of \$986,000 is increased to \$1,031,000. This is due to the revision of the downstream slope and to changing the alignment of the dam.

c. The detailed cost estimate for the Dam, Access Road and Dike is as follows:

TABLE VI

<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Estimated Amount</u>
Preparation of Site	1	Job	L.S.	\$ 40,000
Control & Diversion of Water	1	Job	L.S.	20,000
Uncl. Excavation-General	103,000	C.Y.	0.80	82,400
Rock Excavation-Spillway	50,000	C.Y.	2.65	132,500
Rock Excavation-Outlet	4,200	C.Y.	7.40	31,080
Rock Cleanup	9,000	S.Y.	3.30	29,700
Compacted Earth Fill	263,000	C.Y.	0.26	68,380
Pervious Fill	56,000	C.Y.	1.35	75,600
Uncl. Exc.-Borrow	220,000	C.Y.	0.70	154,000
Gravel Bedding	23,000	C.Y.	1.50	34,500
Road Gravel	14,000	C.Y.	2.00	28,000
Rock Fill	42,000	C.Y.	0.35	14,700
Rock Slope Protection	16,000	C.Y.	2.60	41,600
Fd't'n Drilling & Grouting	1	Job	L.S.	25,000
Anchor Bars	1	Job	L.S.	1,700
Conc.-Spillway Walls & Weir	450	C.Y.	60.00	27,000
Conc.-Outlet Works	375	C.Y.	35.00	13,125
36" Pipe Conduit	405	L.F.	60.00	24,300
Cement	1,230	Bbls.	5.50	6,765
Steel Reinf.	55,000	Lbs.	0.15	8,250
Bubble Gage and Shelter	1	Ea.	L.S.	6,500
Chain Link Fencing	2,800	L.F.	2.50	7,000
Log Boom	1	Job	L.S.	3,000
Staff Gages	1	Job	L.S.	2,000
Trash Rack Structure	1	Job	L.S.	1,500
Grading	3,000	L.F.	0.50	1,500
Road Surfacing	300	C.Y.	2.00	600
Asph. Conc. (3")	2,200	S.Y.	2.00	4,400
Guard Railing	2,200	L.F.	2.00	4,400
Seed & Mulch	25,000	S.Y.	0.20	5,000
Culvert	1	Job	L.S.	2,000
SUB-TOTAL				\$ 896,500
Contingencies - 15%				134,500
TOTAL COST				\$1,031,000

d. The summary of costs for the project based on March 1963 price levels using the Engineering News Construction Cost Index of 884.42 (1913=100) is as follows:

<u>Project Feature</u>	<u>Cost</u>
<u>Land & Damages</u>	\$ 106,000
<u>Relocations</u>	
Roads	309,000
Utility	17,000
Water Supply	235,000
Capitalized value, additional cost of Operation, Water Supply Replacement	140,000
<u>Dam</u>	1,031,000
<u>Preauthorization</u>	20,000
<u>E & D</u>	247,000
<u>S & A</u>	<u>150,000</u>
TOTAL FEDERAL FIRST COST	\$2,255,000

O. SCHEDULE FOR DESIGN AND CONSTRUCTION

62. Design. - Preparation of plans and specifications for the relocation of Wales Road will be completed in October 1963. Preparation of plans and specifications for the dam and appurtenant structures will be completed in November 1963.

63. Construction. - It is estimated that two construction seasons will be required for the completion of this project.

64. Relocations. a. Wales Road passes through the dam site; therefore, its relocation must be initiated as a first step in the construction program to free the work area for the construction of the dam embankment. Construction will be initiated in the Spring of 1964 and completed in the Fall of 1964. The work will be accomplished under an agreement with the Town of Monson.

Relocation of the electric power and telephone lines will be accomplished under separate contracts to be negotiated with the respective utility companies in Fiscal Year 1964.

b. Two of Town water supply wells are in the reservoir and the supply line passes through the dam site. Relocation of these facilities must be initiated early in the construction program.

65. Dam. - A contract for construction of the dam will be awarded in the Spring of 1964. Construction will require two construction seasons.

a. First Construction Season. - During the 1964 construction season, the contractor will mobilize and initiate the clearing and grubbing the sites of the structures and borrow areas. He will construct the cutoff trench and outlet works. He will initiate excavation of the spillway channel and placement of embankment fill on the right bank. Rock excavation from the outlet works and spillway in excess of requirements will be stockpiled.

b. Second Construction Season. - Streamflow will be diverted into the outlet works at the beginning of the construction season. To effect the brook diversion and to construct the dam embankment in the dry, temporary upstream and downstream cofferdams will have to be constructed.

66. Funds Required. - The construction schedule is based on initial funding of \$350,000 in FY 1964 and the assumption that additional funds will be appropriated as required. It is estimated that funds will be required by fiscal years approximately as follows:

<u>Fiscal Year</u>	<u>Amount Required</u>
1964	\$ 350,000
1965	1,140,000
1966	535,000
Allotted to date	230,000*
	<hr/>
TOTAL	\$2,255,000

* Includes \$20,000 preauthorization studies.

P. RESERVOIR REGULATION

67. General. - With an ungated outlet, the reservoir will act as an automatic detention basin storing all flows exceeding the conduit capacity. The selected conduit will permit passage of normal flows of the river without utilizing any appreciable storage in the reservoir. Reservoir stage data will be transmitted to the Barre Falls Flood Control Dam in order to coordinate discharges from both reservoirs.

68. Instrumentation. - In the absence of a gate tower with float well, the record of pool elevations will be obtained with a bubble gage similar to the type used by the U.S. Geological Survey. These records will also yield the discharges from the reservoir by use of a conduit rating curve. Estimated annual cost of reservoir regulation is \$1600.

69. Radio Gage. - Releases from Barre Falls Flood Control Dam must be coordinated with the outflow from Conant Brook to provide maximum protection for the downstream communities on the Chicopee River. Since the dam is unattended, consideration is being given to installation of a transmitter (that will be on call or automatic) to provide the necessary data to the operator at the Barre Falls Dam.

Q. OPERATION AND MAINTENANCE

70. Operation. - No flood control operation will be required. The dam will automatically reduce flood discharges. The dam and appurtenant structures will be maintained and operated in conjunction with the Westville Reservoir.

71. Maintenance. - Maintenance will be based on detailed inspection of the entire works including all operations necessary to preserve the structure. The dam and appurtenant structures will be maintained by the Government under the supervision of the Division Engineer, Waltham, Massachusetts. The staff would be under general supervision of Operations Division of the New England Division. Estimated annual cost for operations and maintenance is \$2,700.

72. Annual Charges. - Annual charges given in Table VII page 31 have been computed as outlined in EM 1120-2-104 using an economic life span of 100 years for the project. The salvage value of land and net loss of taxes for land is not included.

TABLE VII

<u>Item No.</u>	<u>Item</u>	<u>Cost</u>	<u>Total Cost</u>
1.	<u>Federal Investment</u>		
a.	Federal First Cost	\$2,255,000	
b.	Interest during Construction ($1a \times 0.02875 \times \frac{1}{2} T$) ($T=2$ yrs)	<u>64,831</u>	
c.	Total Federal Investment		\$2,319,831
2.	<u>Federal Annual Charges</u>		
a.	Interest ($1c \times 0.02875$)	\$ 66,695	
b.	Amortization ($1c \times 0.00179$)	<u>4,152</u>	
c.	Maintenance & Operation	2,700	
d.	Reservoir Regulation	<u>1,600</u>	
e.	Total Federal Annual Charges		\$ 75,147
3.	<u>Total Annual Benefits</u>		\$ 148,000
4.	<u>Benefit/Cost Ratio</u>	2.0 to 1.	

R. RESERVOIR MANAGEMENT AND PUBLIC USE

73. General. - The Town of Monson, Massachusetts owns and maintains a water supply reservoir immediately downstream of the proposed location of Conant Brook Dam. This reservoir constitutes an emergency water supply used only during periods of severe drought or for fire protection. Recreational use of the Conant Brook Dam and Reservoir area could result in contamination of this water supply. The Commonwealth of Massachusetts, Department of Public Health informed the Board of Water Commissioners, Monson, Massachusetts by letter dated February 20, 1963, that no recreational activities will be permitted on the watershed of Conant Brook Reservoir above the water supply reservoir.

74. Recreation. - Two recreation areas, one at East Brimfield and one at Holland Pond, both within ten road miles of the Conant Brook project, are presently in operation under the jurisdiction of the Corps of Engineers, and receive heavy use. At the request of the Town of Monson, as a supplement to these facilities, consideration is being given to the planning and construction of a permanent pool of about fifty acres, and to furnishing facilities for various day-use

activities at the Conant Brook project. Development of such an area is, however, contingent upon abandonment of the water supply reservoir owned by the Town of Monson, or upon consummation of some permissive agreement between the Town of Monson and the Commonwealth of Massachusetts, Department of Public Health.

Pending completion of studies no estimate of cost is included in this memorandum.

75. Fish and Wildlife Resources. - Principal interest in this project is that Federal lands and included waters be open to free use for hunting and fishing. Continuance of public access is also desirable for fishing the two miles of streams within the reservoir which is stocked with trout. (See Exhibit No. 1).

S. BENEFITS

76. General. - The lower reaches of the Chicopee River have long been the site of concentrated industrial activity as a part of the Springfield, Holyoke, Chicopee industrial complex which is a vital part of the economy of western Massachusetts and the parent Connecticut River Valley. Chicopee Falls, Three Rivers and Monson, located upstream from the effects of the Connecticut River flood stages, have experienced serious flooding from the Chicopee and Quaboag Rivers and their tributaries on several occasions. The flood of record at Monson occurred in August 1955 and slightly lower flood stages were experienced in September 1938. All three communities experienced greatest monetary damages in the flood of August 1955.

The flood of August 1955 caused a total loss in the Chicopee River Basin estimated at over \$21,500,000. Acting after the completed Barre Falls Reservoir, Conant Brook Reservoir would prevent an estimated \$5,600,000 in damages in a recurrence of the 1955 flood. The estimated preventable damages have been computed with Barre Falls Dam and Reservoir in full operation.

77. Annual Benefits. - Annual benefits are derived as the difference between annual losses after Barre Falls Reservoir and the annual losses remaining after the Conant Brook Reservoir Project. The annual benefits to the Conant Brook Dam and Reservoir adjusted to reflect growth projected to occur in the Chicopee River Basin during the life of the project are estimated at \$148,000.

78. Benefit Cost Ratio. - The ratio of benefits to cost is 2.0 to 1.

T. RECOMMENDATION

79. Recommendations. - It is recommended that the plan presented herein for the development of the Conant Brook Reservoir Project be approved for development of Design Memoranda on Embankment and Foundations and Design of Structures and for the preparation of contract plans.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
59 Temple Place
Boston, Massachusetts

April 11, 1962

Division Engineer
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham 54, Massachusetts

Dear Sir:

This letter constitutes a conservation and development report on fish and wildlife resources in relation to the Conant Brook Dam and Reservoir project on Conant Brook in the Town of Monson, Massachusetts, and was prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). It was prepared in cooperation with the Massachusetts Division of Fisheries and Game and has the concurrence of that agency as indicated in its letter of February 23, 1962.

Reference is made to your letter of December 8, 1961 informing us of the status of your studies and requesting our comments on the projects. This project was authorized by the Flood Control Act of 1960.

It is our understanding that the proposed reservoir on Conant Brook would be located at the upstream end of Monson Reservoir in the Town of Monson, Massachusetts. At spillway crest, elevation 754 feet, m.s.l., the reservoir would have an area of about 150 acres and a capacity of 3,840 acre-feet, designed to control a drainage area of 8.0 square miles. The reservoir would be of the dry-bed type, with outlet works consisting of a single ungated 48-inch diameter conduit. During high water periods, flows exceeding the capacity of the conduit would be stored in the reservoir while no water would be stored in the reservoir during low flow periods. We further understand that the Federal Government will acquire in fee simple land within the reservoir area to at least the spillway crest elevation.

Monson Reservoir is used for water supply for the Town of Monson during peak demands. This reservoir would have the same use after construction of Conant Brook Reservoir and officials of the Town of Monson have indicated that they do not want a recreation pool held in Conant Brook Reservoir because of possible contamination to Monson Reservoir.

The fish and wildlife aspects of this reservoir area are not significantly important. The area above the proposed dam is stocked annually with trout by the State Division of Fisheries and Game. The area consists of approximately two miles of streams and receives moderate fishing pressure.

EXHIBIT NO.1

Following project construction it is expected that the fishery values of Conant Brook and tributaries within the project area would be slightly reduced.

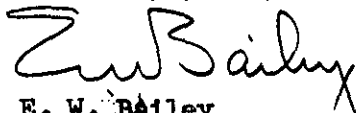
The major portion of the 150 acres affected by the project is in woodland, while the remainder is open land and brush swamp. This includes wildlife habitat presently utilized by cottontails, squirrels, and grouse. Hunting opportunity is limited because of the generally long and narrow shape of the area, small acreage involved, and the network of roads passing through the area. Since State law prohibits the discharge of firearms within 50 yards of State or paved roads, a large portion of this small area is closed to hunting. The project would cause little or no damage to the wildlife resources and the abandonment of roads in the reservoir area will open more of the area to hunting.

Our principal interest in this project is that the Federal lands and included waters be open to free use for hunting and fishing. The Massachusetts Division of Fisheries and Game will post "Safety Zone" signs if public use is provided in the project area. Continuance of public access is also desirable for fishing the two miles of stream within the reservoir which are stocked with trout.

We recommend that all Federally-owned lands and included water areas be open to free use for hunting and fishing so long as title to the lands and structures remains in the Federal Government except for sections reserved for safety, efficient operation, or protection of public property.

No further studies by this Bureau are considered necessary unless changes are made in your project plans. Please advise us if changes are made so that we may evaluate their effect upon fish and wildlife resources.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "E. W. Bailey". The signature is fluid and cursive, with the first name "E. W." written in a more compact, stylized manner than the last name "Bailey".

E. W. Bailey
Acting Regional Director

REGION ONE

CONNECTICUT
MAINE
MASSACHUSETTS
NEW HAMPSHIRE
NEW JERSEY
NEW YORK
RHODE ISLAND
VERMONT
PUERTO RICO

U. S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS

14 Court Square
Boston 8, Massachusetts

Conant Brook Dam - Monson, Massachusetts

February 14, 1962

Mr. John W. Leslie, Chief
Engineering Division
Corps of Engineers
424 Trapelo Road
Waltham 54, Massachusetts

Dear Mr. Leslie:

This will acknowledge receipt of your letter dated December 6, 1961, concerning the subject flood control project in the Town of Monson.

We have contacted the Massachusetts Department of Public Works concerning the possible use of this dam as a public highway bridge insofar as our Federal-aid highway systems are concerned and find that the Department has already replied to your inquiry by letter dated December 20, 1961, and signed by S. J. McCarthy, Chief Engineer.

Since under our enabling legislation the State Department of Public Works has the prerogative to initiate Federal-aid highway system revision and construction projects on these systems, we feel their above referenced letter to you is ample indication that they have considered the feasibility of using the proposed dam as a highway link and find it economically undesirable. We concur in their position.

We regret that this reply to your letter is late, and we will attempt to furnish you a more prompt reply to these inquiries in the future.

Very truly yours,

J. A. Hanson
Division Engineer

EXHIBIT NO.2



The Commonwealth of Massachusetts

Department of Public Works

100. Vashua Street, Boston 14

December 20, 1961

John W. Leslie, Chief
Engineering Division
Corp of Engineers
424 Trapele Road
Waltham 54, Massachusetts

Dear Mr. Leslie:

This will acknowledge receipt of your letter, dated December 6, 1961, in which you requested that the Massachusetts Department of Public Works determine and certify that a road over the top of the Conant Brook Dam in Monson is economically desirable and needed as a link in the Federal Aid Highway System.

A review of the map submitted with your letter indicates that a road across the top of the dam would not be economically desirable or needed as a link in the State or Federal Aid Highway System. However, the construction of the dam will require the abandonment of several local streets, which must be relocated in order that a local network of highways could be provided. It is assumed, by this Department, that the local authorities involved will be given ample opportunity to voice their opinion as to the proposed solution of the local network problem.

Very truly yours,

E. J. McCarthy
E. J. MCCARTHY
Chief Engineer

CEW:pen



OFFICE OF THE DIRECTOR

The Commonwealth of Massachusetts
Water Resources Commission
73 Tremont Street, Boston 8

February 6, 1962

Mr. John W. Leslie
U. S. Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts

RE: Conant Brook Flood
Control Project.

Dear Mr. Leslie:

I am in receipt of your letter of January 17, 1962, in which you inform this office that the design studies for the Conant Brook Flood Control Reservoir Project will be undertaken shortly.

I have checked with the Department of Natural Resources and the Division of Fisheries and Game and their position insofar as recreational development is concerned is the same as contained in this Commission's letter of July 17, 1959. I believe that the Division of Fisheries and Game have indicated that they will continue to stock trout in Conant Brook as they feel that this is a good trout stream.

I wish to thank you for giving us the opportunity to again express the views of the appropriate State agencies in regard to the possibility of recreational development in this reservoir.

Sincerely yours,

Clarence I. Sterling, Jr.

Clarence I. Sterling, Jr.
Director and Chief Engineer

CIS/n

EXHIBIT NO.4



SELECTMEN and BOARD of HEALTH

Memorial Town Hall

Monson, Massachusetts

December 14, 1962

J. M. Geoghegan, Chief
Real Estate Division
U.S. Army Engineer Division
424 Trapelo Road
Waltham, 54, Massachusetts

Dear Sir:

After considerable discussion, the Board of Selectmen wishes to inform you that we are very much in favor of establishing a Recreation Area near the proposed Dam Site of the Flood Control Project on Conant Brook in Monson.

Inasmuch as the Town has no public recreation facilities, we feel that this would be a very desirable improvement.

From the contour map we feel that a depth of water with a ten foot minimum be figured in your final plans.

We would be glad to meet at your office to discuss this further, and would appreciate any advice you might be able to give us as to the best way of establishing this Recreation Area.

Very truly yours,

Richard J. Sullivan
Charles P. Talbot
Thomas W. Hildreth
BOARD OF SELECTMEN

FJS:L

EXHIBIT NO.5



SELECTMEN and BOARD of HEALTH

Memorial Town Hall

Monson, Massachusetts

February 12, 1963

Mr. John Castonza
Army Corps of Engineers
1124 Trapelo Road
Waltham, 54, Massachusetts

Dear Mr. Castonza:

At a meeting of the Board of Selectmen and the Water Commissioners held last evening, it was decided to request a meeting between the two Boards and yourself, the time and place to be decided by you.

During the course of the meeting, it was suggested that a Filter System be installed between the planned Recreation Area and the present Conant Brook Reservoir before the Commission alters the present system.

An early reply telling us when it will be convenient for you to meet with us will be greatly appreciated.

Very truly yours,

Frederick H. Sullivan
Thomas W. Haley
Charles S. Balda
BOARD OF SELECTMEN

TWH:L
CC-Water Commissioners

EXHIBIT NO. 6



THE COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF PUBLIC HEALTH

STATE HOUSE, BOSTON 33

February 20, 1963

Board of Water Commissioners
Mendon
Massachusetts

Re: MENDON
Public Water Supply
Proposed Recreational Use of
Flood Control Reservoir above
Conant Brook Reservoir

Gentlemen:

In response to the request contained in your communication dated February 7, 1963, an examination has been made of Conant Brook Reservoir, one of the sources of water supply of the town of Mendon, and its relation to a proposed flood control reservoir to be constructed upstream from the Reservoir.

The Department is informed that some consideration is being given to providing a permanent pool in the flood control reservoir and to developing recreational activities on it. There would be a direct connection between the permanent pool and Conant Brook Reservoir.

Whenever Conant Brook Reservoir is used as a source of water supply for Mendon, rules and regulations to prevent the pollution and secure the sanitary protection of its waters are in effect and prohibit bathing in the Reservoir or any tributary to it, and also prohibit fishing except by written permit by your Board.

The Department must insist, therefore, that no recreational activities be permitted on the watershed of Conant Brook Reservoir, and that the rules and regulations referred to above be strictly enforced.

Very truly yours,

Worthington H. Taylor
Director
Division of Sanitary Engineering

c- Board of Health
Mendon

c- U.S. Army, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts

T/Esou
\$152

EXHIBIT NO.7

APPENDIX A

ATTORNEY'S

REPORT

APPENDIX A

ATTORNEY'S REPORT

RE: CONANT BROOK DAM AND RESERVOIR PROJECT, MASSACHUSETTS, ROADS,
UTILITIES, AND WATER SUPPLY FACILITY

I. ROADS

1. The Conant Brook Dam and Reservoir Project will be located in the Town of Monson, County of Hampden, in the Commonwealth of Massachusetts. There are a number of roads in the Town of Monson that will be affected by the construction, maintenance and operation of the Conant Brook Dam and Reservoir Project. Therefore, the relocation, rearrangement, alteration and/or abandonment of roads will be required. There are no State Highways affected by this Flood Control Project, only Town and County roads. Some of these roads are ancient layouts by the County but are presently operated and maintained as Town highways.

2. The law relating to County and Town roads is found in the provisions of Chapters 40 and 82 of the General Laws of Massachusetts and the applicable sections are as follows:

CHAPTER 40

Powers and Duties of Cities and Towns

Section 15. Abandonment of Land or Easements. - If any officer of a city or town having charge of any land, easement or right taken for such city or town, otherwise than by purchase, notifies the City Council or the Selectmen that, in his opinion, such land, easement or right, or part thereof, is no longer required for public purposes, and if thereafter the City Council or the inhabitants of the town by a two thirds vote authorize the conveyance of such land, or of part thereof, or the abandonment of such easement or right, or part thereof, and specify the minimum amount to be paid for such conveyance or abandonment, the Mayor or the Selectmen may, for such amount or a larger amount and upon such other terms as the Mayor or Selectmen shall consider proper, convey said land, or part thereof, by deed, or declare said easement or right, or part thereof, to be abandoned. Such declaration, being recorded in the registry of deeds for the district where the land is situated, shall extinguish the easement or right.

CHAPTER 82

The Laying Out, Alteration, Relocation and Discontinuance of Public Ways, and Specific Repairs Thereon

Procedure of County Commissioners in Respect to Highways

Section 1. Jurisdiction of County Commissioners. - County Commissioners within their respective counties may lay out, alter, relocate and discontinue highways and order specific repairs thereon in the manner herein provided, unless other provision is made by law. Sections one to thirteen, inclusive, shall apply to City Councils or Aldermen when authorized by city charters to lay out, alter, relocate and discontinue highways and to order specific repairs thereon, so far as applicable, and any hearing under any provision of said sections required to be held before a City Council or Board of Aldermen so authorized may be held before a duly authorized committee thereof.

Section 2. Petition and Bond. - If common convenience and necessity require a new highway from town to town or from place to place within the same town, or the alteration, specific repair or discontinuance of an existing highway, application therefor shall be made by petition in writing, to the County Commissioners having jurisdiction thereof. The petitioners shall, if so required by the County Commissioners, before any action is taken upon such petition, cause a sufficient recognizance to be given to the county, with surety to the satisfaction of the Commissioners, for the payment of all costs and expenses to the county which shall arise by reason of the proceedings on such petition, if the petitioners do not prevail.

Section 10. Specific Repairs. - If, upon a petition for the laying out or alteration of a highway, the Commissioners, after a view and hearing are of the opinion that the existing highway between the termini mentioned in the petition can be so far amended as to supersede the necessity of laying out a new highway or of altering the the location of existing ways, they may, after notice to the towns interested, direct specific repairs to be made in the existing ways in such manner as the public convenience may require; and may apportion the expense thereof upon the county and towns respectively as in laying out highways. At the time or ordering specific repairs upon a highway, they may direct it to be closed for public travel for a reasonable time. Towns in which specific repairs are ordered shall make them. Nothing in this chapter with respect to the Commissioners' orders for specific repairs shall relieve towns from their duties and liabilities with respect to keeping public ways in repair.

Section 11. Relocation. - If application is made to the Commissioners by a town, or by five inhabitants thereof, to relocate or order specific repairs on a way within such town, whether it was laid out by authority of the town or otherwise, they may, either for the purpose of establishing the boundary lines of such way or of making alterations in the course or width thereof, or of making specific repairs thereon, relocate it in the manner prescribed for laying out highways in sections two to nine, inclusive. The expense shall be assessed upon the petitioners or upon the county or town, or upon the land benefited by the improvement under chapter eighty, as the Commissioners may order. The Commissioners may, without petition, after giving notice as provided in section three, relocate any public way for the purpose of establishing its boundaries, or of making specific repairs thereon, in which case no part of the expense shall be assessed upon the town.

The Commissioners may adjudicate and decree in respect to a portion of a way described in a petition pending before them, leaving the petition open pending a further or final adjudication and decree in respect to a further portion of said way or a final adjudication and decree as to the remainder of such way.

Procedure of City and Town Officials in Respect to Highways

Section 17. Jurisdiction of Cities and Towns over Highways. - The City Council of a city and the Selectmen or Road Commissioners of a town may exercise original jurisdiction, concurrent with the County Commissioners, of petitions for altering, relocating or making specific repairs upon a highway within the town limits, but except as to such parts thereof as, by such action, become unnecessary for public use, a city or town shall not discontinue any highway or diminish the width thereof, nor shall it assess upon the county any part of the expense of altering, relocating or repairing. The proceedings of cities and towns and their officers hereunder shall be the same as in the laying out of highways or town ways. Nothing in sections seventeen to nineteen, inclusive, shall diminish the powers over highways granted to a city by its charter.

Section 18. Record of Action to be Sent to County Commissioners.- Within two weeks after final action relative to the alteration or relocation of a highway or making specific repairs thereon, under the preceding section, the town clerk shall send a certified copy of the record of such final action to the County Commissioners, who shall enter it upon their records.

Section 19. Appeal to County Commissioners. - An appeal may be taken to the County Commissioners from any action under the two preceding sections, and they shall thereupon give a public hearing, with not less than fourteen days' notice thereof, in the manner required in the laying out of highways or town ways and also be publishing in a newspaper a copy of the notice not less than seven days before the hearing. At such hearing the County Commissioners may finally decide such appeal.

Procedure of City and Town Officers in Respect to
Town Ways and Private Ways

Section 21. Jurisdiction over Town Ways. - The Selectmen or Road Commissioners of a town or city council of a city may lay out, relocate or alter town ways, for the use of the town or city, and private ways for the use of one or more of the inhabitants thereof; or they may order specific repairs to be made upon such ways; and a town, at a meeting, or the city council of a city, may discontinue a town way or a private way.

Section 22. Notice. - Seven days at least prior to the laying out, relocation or alteration of a town way or private way a written notice of the intention of the Selectmen or Road Commissioners of the town to lay out, relocate or alter the same shall be left by them, at the usual place of abode of the owners of the land which will be taken for such purpose, or delivered to such owner in person or to his tenant or authorized agent. If the owner has no such place of abode in the town and no tenant or authorized agent therein known to the Selectmen or if, being a resident in the town, he is not known as such to the Selectmen or Road Commissioners, such notice shall be posted in a public place in the town seven days at least before the laying out, relocation or alteration of such way. This section shall not apply to cities.

Section 23. Acceptance by Town. - No town way or private way which has been laid out, relocated or altered by the Selectmen or Road Commissioners shall, except as hereinafter provided, be established until such laying out, relocation or alteration, with the boundaries and measurements of the way, is filed in the office of the town clerk and, not less than seven days thereafter, is accepted by the town at a town meeting. This section shall not apply to cities.

Section 24. Taking by Eminent Domain and Damages. - If it is necessary to acquire land for the purposes of a town way or private way which is laid out, altered or relocated by the Selectmen, Road Commissioners or officers of a town under this chapter, such officers shall within thirty days after the termination of the town meeting at which the laying out, alteration or relocation of such town way or private way is accepted by the Town, adopt an order for the taking of such land by eminent domain under chapter seventy-nine or institute proceedings for such taking under chapter eighty A. Any person sustaining damage in his property by the laying out, alteration or relocation of a town way or private way shall be entitled to recover the same under said chapter seventy-nine, unless such damage was sustained in connection with a taking made in proceedings instituted under said chapter eighty A, and any persons sustaining damage in his property by the discontinuance of a town way or private way or by specific repairs thereon shall be entitled to recover the same under said chapter seventy-nine. If no entry has been made upon land taken under said chapter seventy-nine for the purpose of a town way, or if the location has for any other cause become void, a person who has suffered loss or been put to expense by the proceedings shall be entitled to recover indemnity therefor under said chapter seventy-nine. If a private way is laid out, relocated, altered or discontinued by a town, or if a town makes specific repairs thereon, or if a town way is discontinued, the persons upon whose application such way is laid out, relocated, altered or discontinued or upon whose application specific repairs are made thereon shall, before such way is entered upon for the purposes of construction or is closed up, give such town security satisfactory to the Selectmen that they will indemnify such town for all damages and charges which it is obligated to pay by reason thereof, and all such damages and charges shall be repaid to the town by the persons making such application; provided, however, that in case of the discontinuance of a town way the Selectmen may order a part of the damages to be paid by the town. The first sentence of this section shall not apply to cities.

Procedure of County Commissioners In Respect to Town Ways
and Private Ways

Section 26. Unreasonable Refusal of Selectmen to Act. - If the Selectmen or Road Commissioners unreasonably refuse or neglect to lay out, relocate or alter a town way or private way when requested in writing, by one or more of the inhabitants of a town, the County Commissioners, on the petition in writing of a person aggrieved, filed within one year after such request, may lay out, relocate or

alter such way, and may determine its boundaries and measurements, and, if it is necessary to acquire land for the purpose of such way, may take the same by eminent domain on behalf of the town under chapter seventy-nine, and the costs of the proceedings shall be paid by the town. If it is a private way, the damages and costs, or such part thereof as the County Commissioners consider reasonable, shall be repaid to the town by the persons for whose use it was laid out, relocated or altered, and security for such payment, satisfactory to the County Commissioners, shall be given to the town by such persons before the way is entered upon for the purpose of constructing or altering the same.

Section 27. Unreasonable Refusal of Town to Accept a Way. - If a town unreasonably refuses or delays to accept a town way or private way laid out, relocated or altered by the Selectmen or Road Commissioners, any person aggrieved thereby may within one year thereafter apply by petition in writing to the County Commissioners, who, unless sufficient cause is shown against such application, may approve the way as laid out, relocated or altered by the Selectmen or Road Commissioners and may direct the laying out, relocation or alteration and approval to be recorded by the clerk of such town, which shall have like effect as if accepted by the town.

Section 28. Completion of Way by County Commissioners. - If a town in which a town way or private way has been laid out, relocated, altered or approved in pursuance of the two preceding sections does not make and complete the same in the manner prescribed by the County Commissioners, and to their satisfaction, within six months after it has been laid out, relocated, altered or approved, or within the time directed by them, they shall, forthwith, cause such way to be completed, and the expenses, interest and charges thereof shall be determined and paid in the manner provided in sections fourteen and fifteen.

Section 30. Discontinuance by Commissioners. - Upon the application in writing of a person aggrieved by the refusal of a town to discontinue a town way or private way, the County Commissioners may order such way to be discontinued. If a town way has been laid out, relocated or altered by the County Commissioners, it shall not within two years thereafter be discontinued, relocated or altered by the town; and if such way has been discontinued by the County Commissioners, the town shall not within two years thereafter lay out the same again.

Section 32. Record of Laying Out Conclusive. - When a town or private way is laid out, relocated or altered by the Selectmen or Road Commissioners or by the County Commissioners, they shall in their report or return thereof specify the manner in which such way is laid out, relocated or altered and shall transmit to the town clerk a description of the location and bounds thereof, which shall within ten days be recorded by him in a book kept for that purpose; and no town shall contest the legality of a way laid out by it and accepted and recorded as provided in this chapter. Sections twenty-six to thirty-two, inclusive, shall apply to cities.

Section 32A. Discontinuance of Certain Ways As Public Ways. - Upon petition in writing of the board of officers of a town having charge of a public way, the County Commissioners may, whenever common convenience and necessity no longer require such way to be maintained in a condition reasonably safe and convenient for travel, adjudicate that said way shall thereafter by a private way and that the town shall no longer be bound to keep the same in repair, and thereupon such adjudication shall take effect; provided, that sufficient notice to warn the public against entering thereon is posted where such way enters upon or unites with an existing public way. This section shall not apply to ways in cities.

3. Town of Monson Roads. - There are eight roads in the Town of Monson that will be affected by the Conant Brook Dam and Reservoir Project, namely New Wales Road, East Hill Road, Blanchard Road, Waterworks Road, Sutcliffe Road, Munn Road, Pond Road, and Old Wales Road. An examination of the town records have been made and no records of the layout of East Hill Road, Blanchard Road, Waterworks Road, Sutcliffe Road, Munn Road, Pond Road, and Old Wales Road could be identified as such in view of the fact that these are ancient highways. However, these eight roads are shown as public highways on the map of the Town of Monson and are recognized as public highways and furthermore, have been maintained and operated by the Town of Monson in their highway network. The County Commissioners of Hampden County laid out New Wales Road in April 1845 and relocated sections thereof in 1908, 1933, 1934, 1935 and 1936. Also a section of Pond Road about fifty rods in length was laid out by the County Commissioners of Hampden County on January 2, 1849. However, New Wales Road and Pond Road including the section laid out by the County have been maintained and operated by the Town of Monson as part of its road system for many years. Therefore, it is the opinion of the undersigned that East Hill Road, Blanchard Road, Waterworks Road, Sutcliffe Road, Munn Road, Pond Road (exclusive of the County layout),

and Old Wales Road are public highways of the Town of Monson and under its control and jurisdiction; that it has a compensable interest therein and is entitled to the reasonable cost of any necessary relocation, rearrangement and/or alteration. It is also the opinion of the undersigned that New Wales Road and the section of Pond Road laid out by the County are public roads under the control and jurisdiction of the Town of Monson and County of Hampden and that the Town of Monson and County of Hampden have a compensable interest therein and are entitled to the reasonable cost of any necessary relocation, rearrangement and/or alteration.

II. UTILITIES

1. Massachusetts Electric Company. - The Massachusetts Electric Company maintains and operates distribution lines within the proposed reservoir area in the Town of Monson, Massachusetts. In January 1961 the name was changed to the Massachusetts Electric Company from the Worcester County Electric Company. Town records show grants to the Electric Company jointly with the New England Telephone and Telegraph Company for licenses to erect and maintain pole lines on public highways. Generally these facilities are on public highways within the project and will be affected by the construction, maintenance and operation of the Conant Brook Dam and Reservoir Project and the relocation, rearrangement and/or alteration of these facilities will be required. All poles are jointly owned between the Electric Company and the Telephone Company with custody in the Electric Company. Therefore, it is the opinion of the undersigned that Massachusetts Electric Company has a compensable interest therein and is entitled to the reasonable cost of any necessary relocation, rearrangement and/or alteration of its facilities.

2. New England Telephone and Telegraph Company. - The New England Telephone and Telegraph Company maintains exchange circuits within the Conant Brook Dam and Reservoir area. Generally these poles and wires are on public highways and are jointly owned and occupied with Massachusetts Electric Company. The Selectmen of the Town of Monson granted licenses to erect and maintain these pole lines within the public highways. These facilities will affect the construction, maintenance and operation of the Conant Brook Dam and Reservoir Project and the relocation, rearrangement and/or alteration of these facilities will be required. Therefore, it is the opinion of the undersigned that the New England Telephone and Telegraph Company has a compensable interest therein and is entitled to the reasonable cost of any necessary relocation, rearrangement and/or alteration of its facilities.

3. Tennessee Gas Transmission Company. - The Tennessee Gas Transmission Company owns and operates a gas pipe line buried in the ground which runs in an east-west direction south of the proposed Government dam and in the reservoir area. The Company's pipe line is installed in easements acquired from private landowners. The Company has advised this office that no additional work is required to protect its pipe line through the project. It is the opinion of the undersigned that the Company has a compensable interest therein. It is proposed to subordinate the Company's real estate interests to the right of the Government to flood and overflow same for project purposes.


III. CEMETERIES

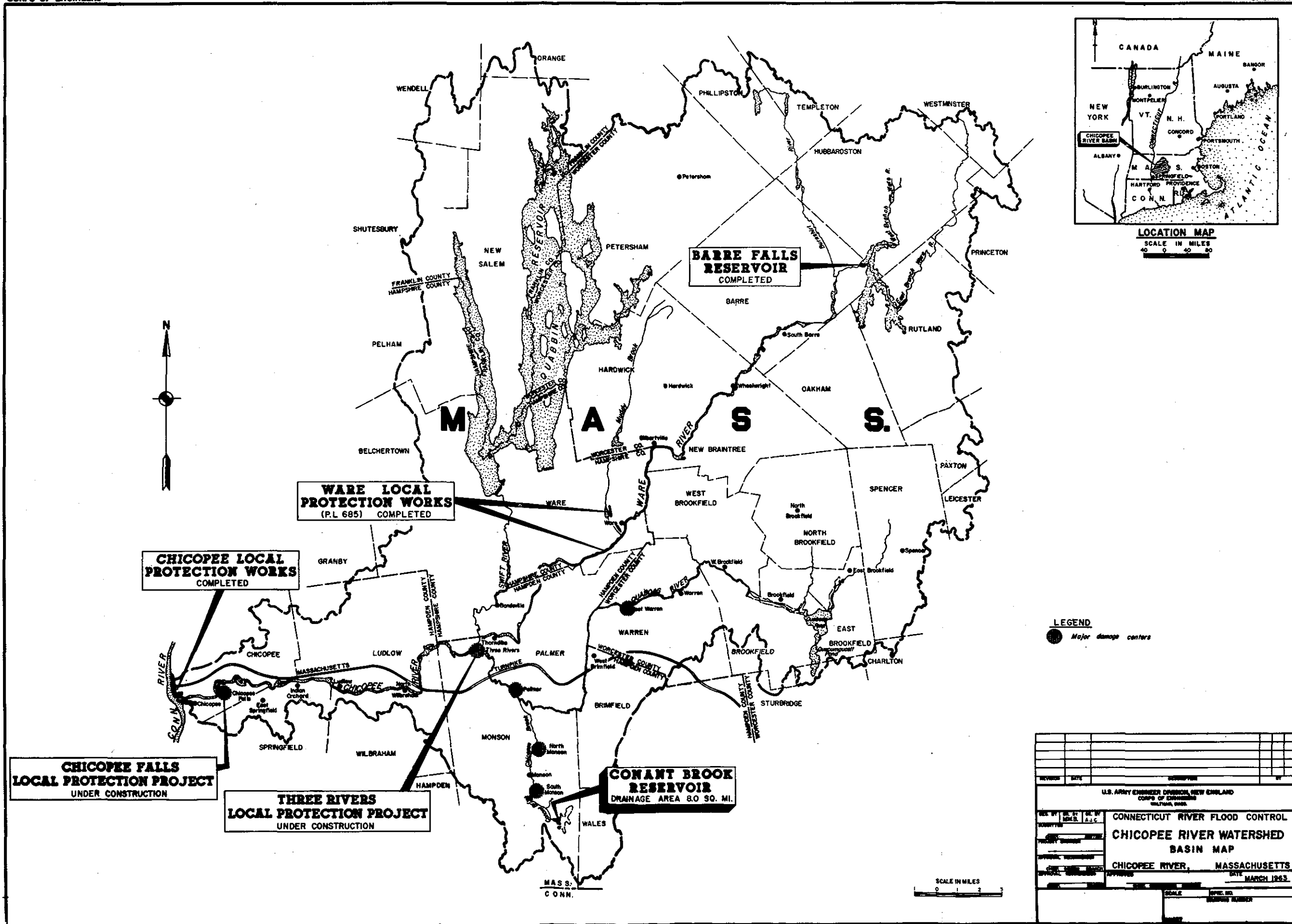
Moulton Hill Cemetery. - The Moulton Hill Cemetery is located in the Town of Monson and is within the 300' horizontal peripheral strip immediately adjacent to spillway crest elevations.

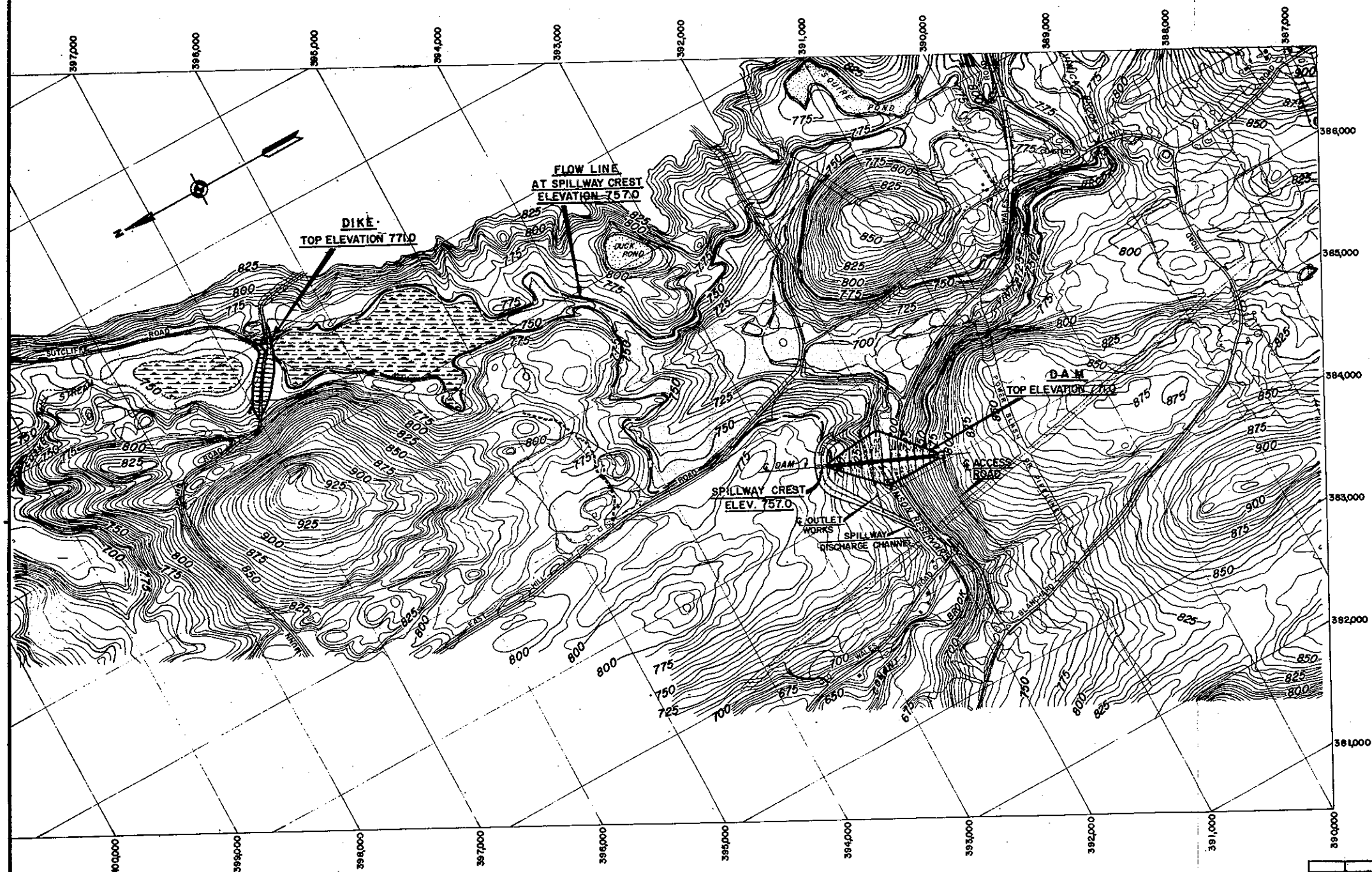
IV. WATER SUPPLY FACILITY

The Town of Monson owns and operates a well water supply system within the proposed reservoir area. This water works was constructed by the Town in 1895, pursuant to Chapter 290 of Massachusetts Legislative Acts of 1894. Also, the Town constructed a dam and reservoir on Conant Brook just below the proposed Government dam on the same stream. The Town acquired its rights for this water system by deeds from land owners in fee and easement. The construction and operation of the flood control will affect the Town's water supply system and the relocation, rearrangement, and/or alteration of these facilities will be required. Therefore, it is the opinion of the undersigned that the Town of Monson has a compensable interest therein and is entitled to the reasonable cost of any necessary relocation, rearrangement, and/or alteration of its facilities.

7 December 1962


MORRIS S. PHILLIPS, Attorney
Real Estate Division





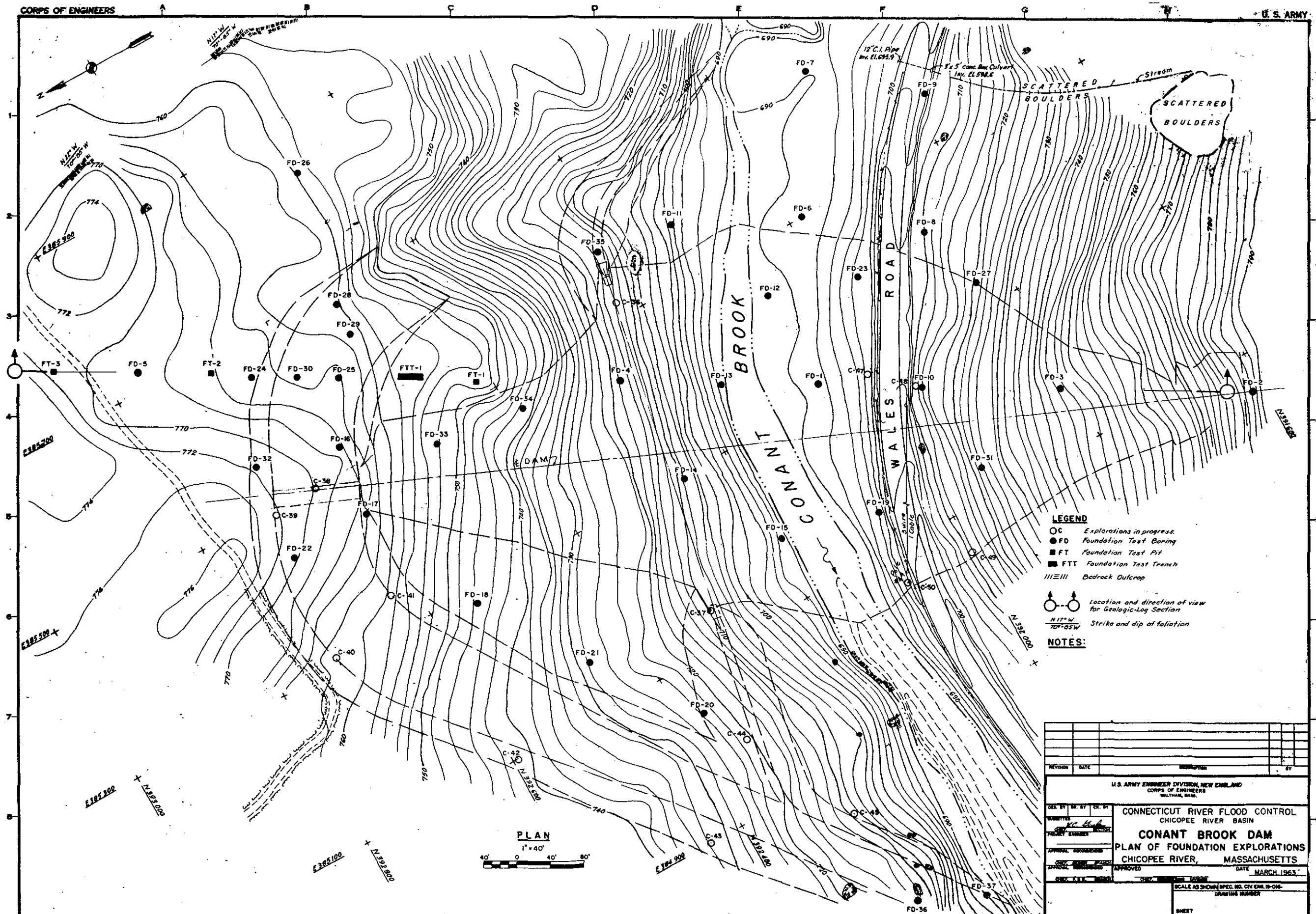
NOTES:
Elevations refer to Mean Sea Level.

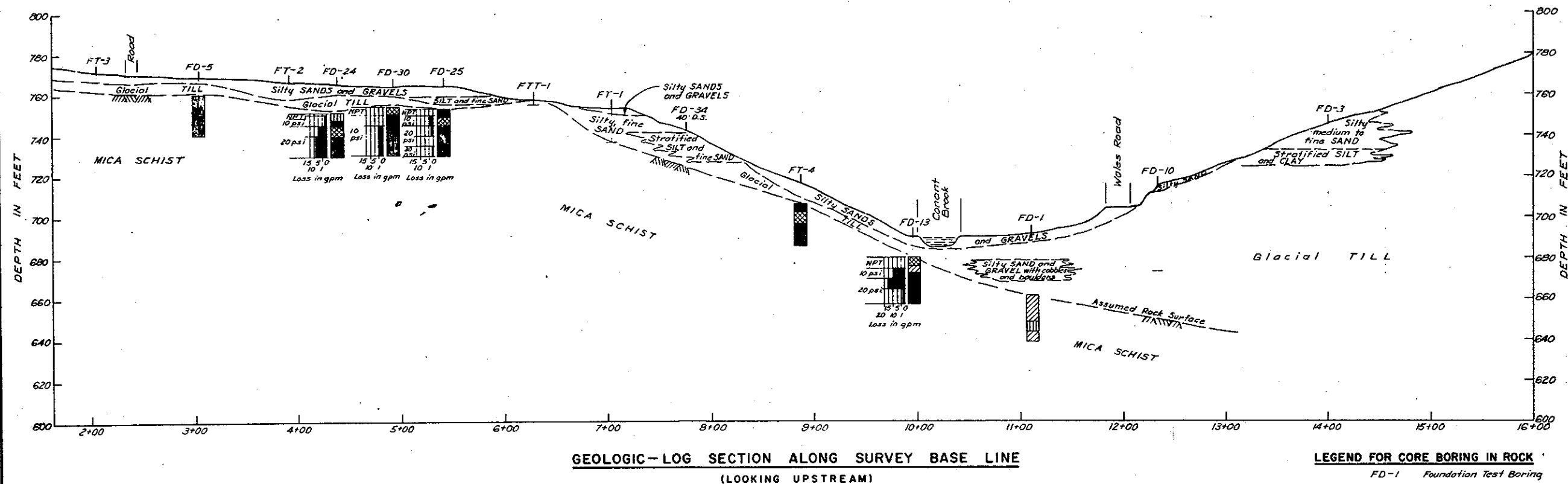
RESERVOIR PLAN

SCALE IN FEET
0 400 800

DES. BY A.J.C.		CHK. BY A.J.C.	
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
CONNECTICUT RIVER FLOOD CONTROL CHICOPEE RIVER BASIN			
CONANT BROOK DAM RESERVOIR MAP			
CHICOPEE RIVER,		MASSACHUSETTS	
DATE		MARCH 1963	
SCALE 1" = 400'			





**LEGEND FOR CORE BORING IN ROCK**

FD-1 Foundation Test Boring	
NPT	Rock core recovery 0-25%
10 psi	Rock core recovery 25-50%
20 psi	Rock core recovery 50-75%
30 psi	Rock core recovery 75-90%
40 psi	Rock core recovery 90-100%

NPT No Pressure Test Performed. Asterisk denotes that section could not be sealed for testing.
 10 psi Constantly maintained pressure for 1 to 5 minutes.
 Volume loss in gallons per minute under constant pressure, tested continuously in 5 foot sections.
 Scale expanded from 0 gpm to 1 gpm for clarification of low flow losses.

NOTE

The glacial till consists principally of gravelly silty sand containing numerous cobbles and occasional boulders. Included also are substantial sections of silty sand, thin layers of silt and clay, and seams of relatively clean sand. The till grades with depths from brown, moderately compact to gray, very compact.

REVISION	DATE	DESCRIPTION	BY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
CONNECTICUT RIVER FLOOD CONTROL CHICOPEE RIVER BASIN			
CONANT BROOK DAM GEOLOGIC-LOG SECTION			
CHICOPEE RIVER, MASSACHUSETTS			
APPROVED: MARCH 1963			
DRAWN: MARCH 1963			
SCALE: 1" = 10' HORIZONTAL, 1" = 20' VERTICAL			
SHEET			

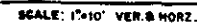
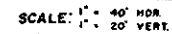
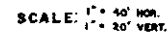
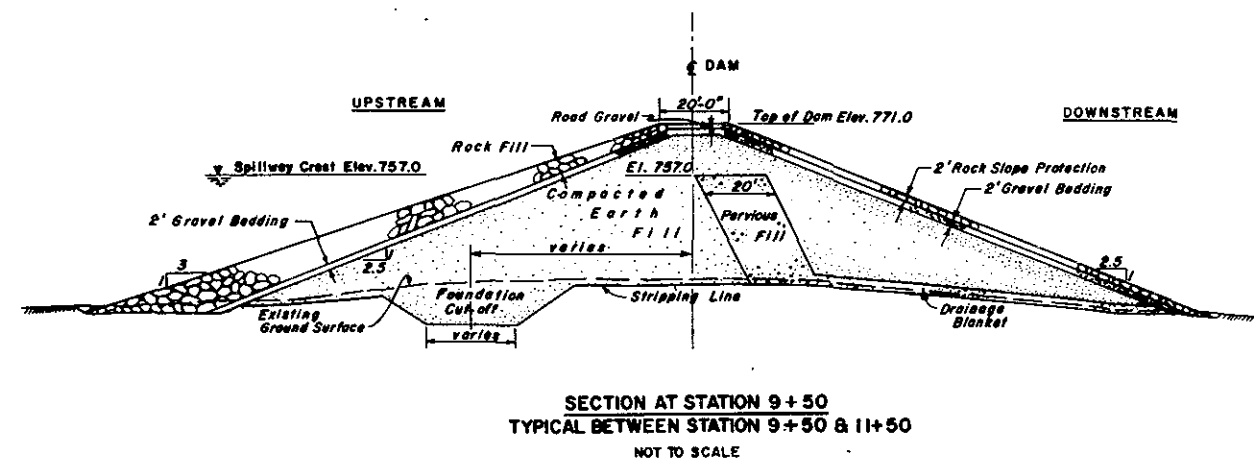
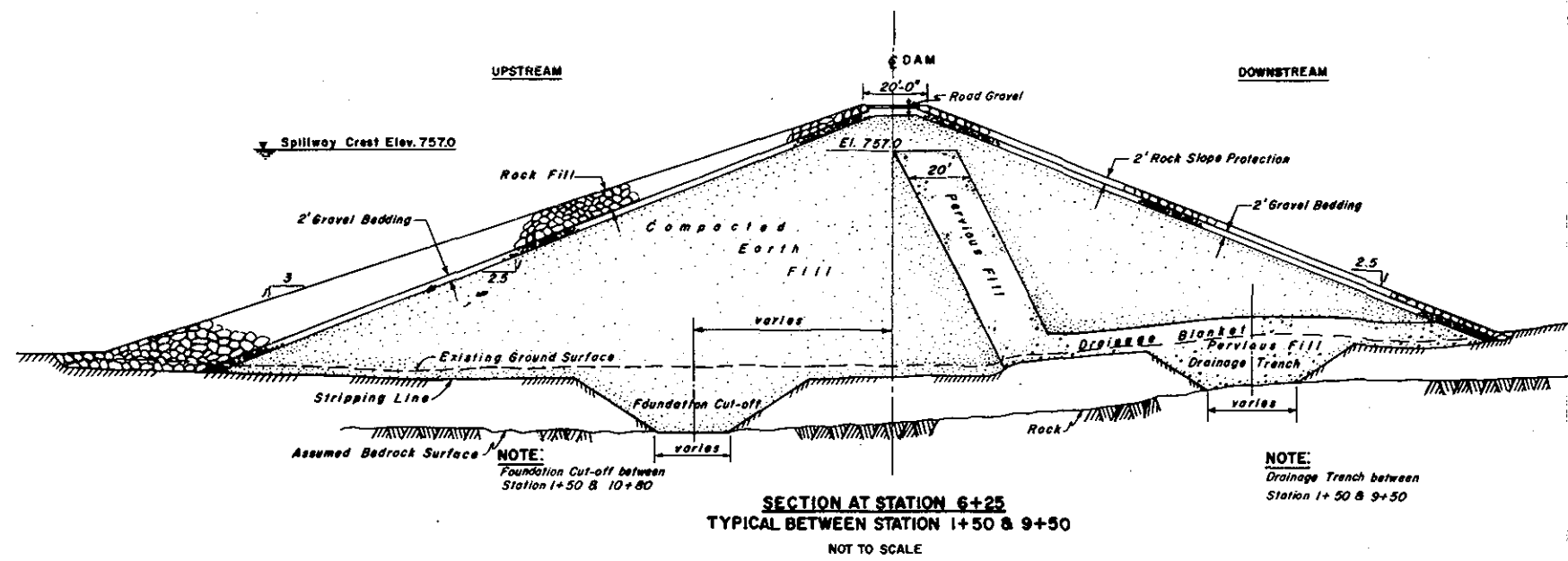
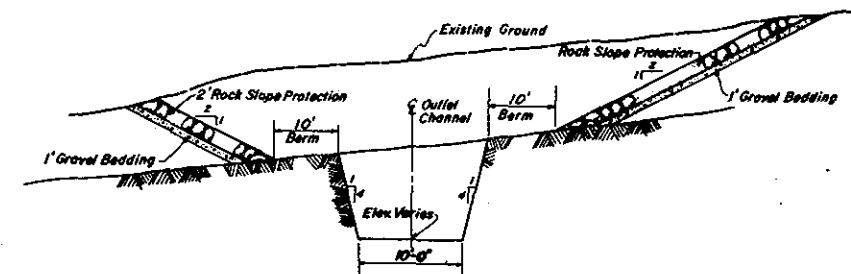
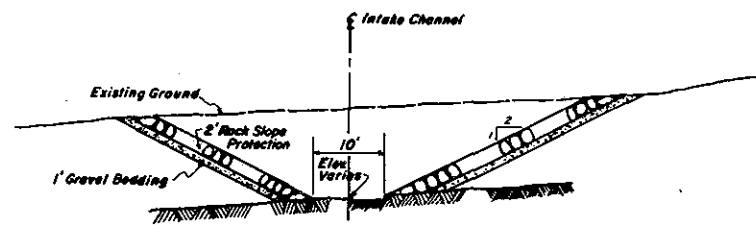
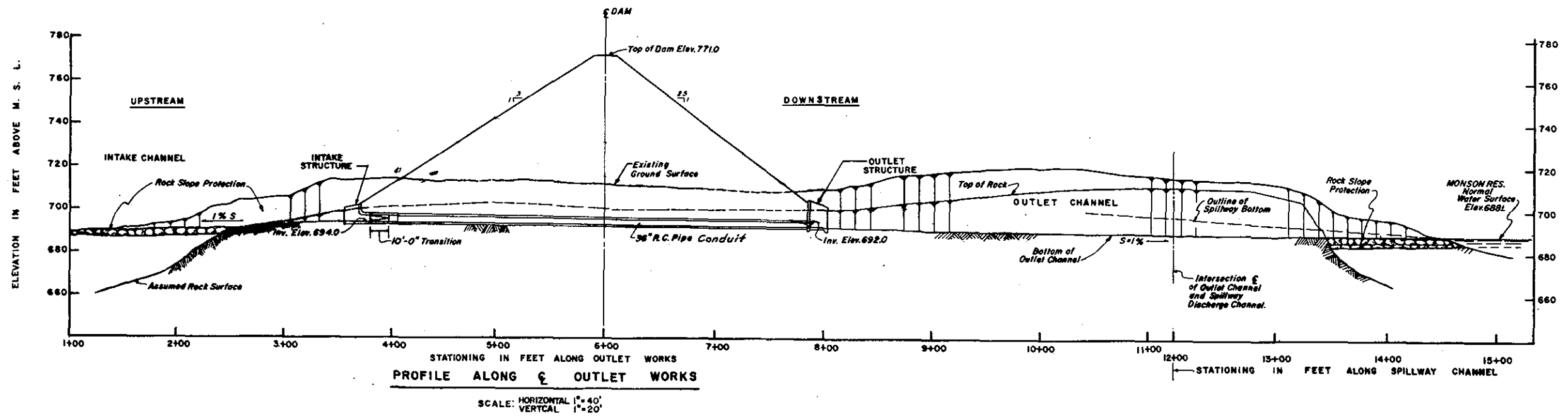


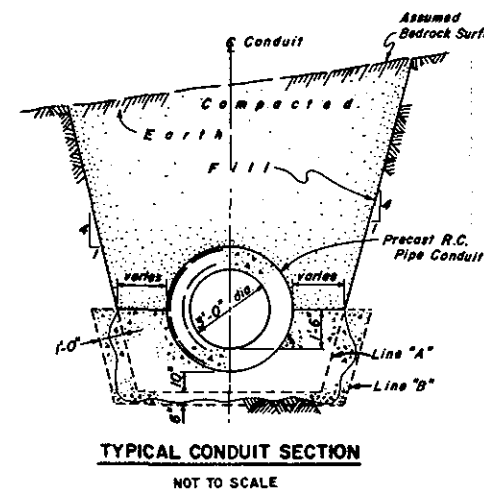
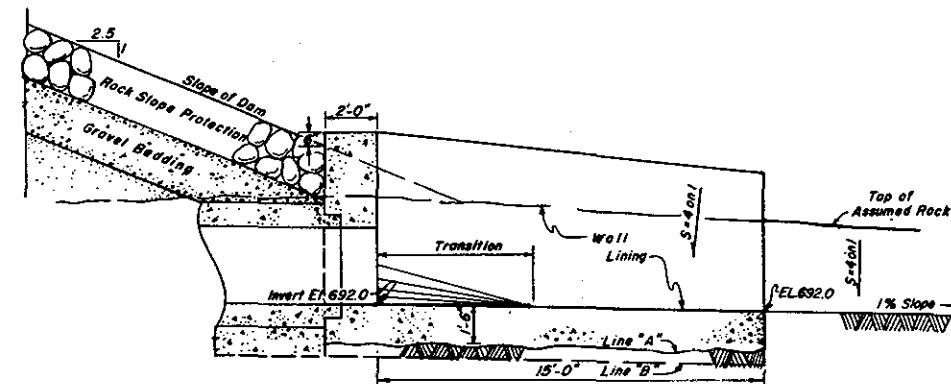
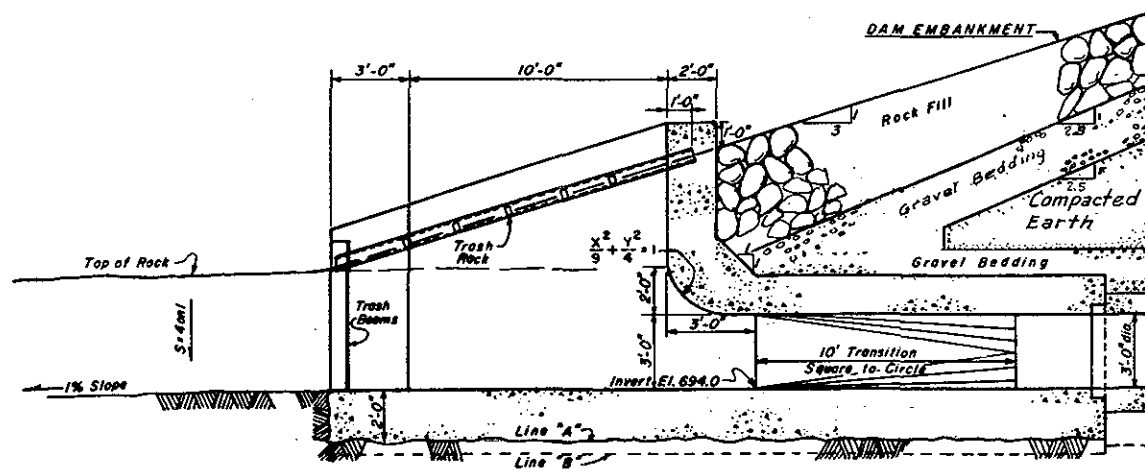
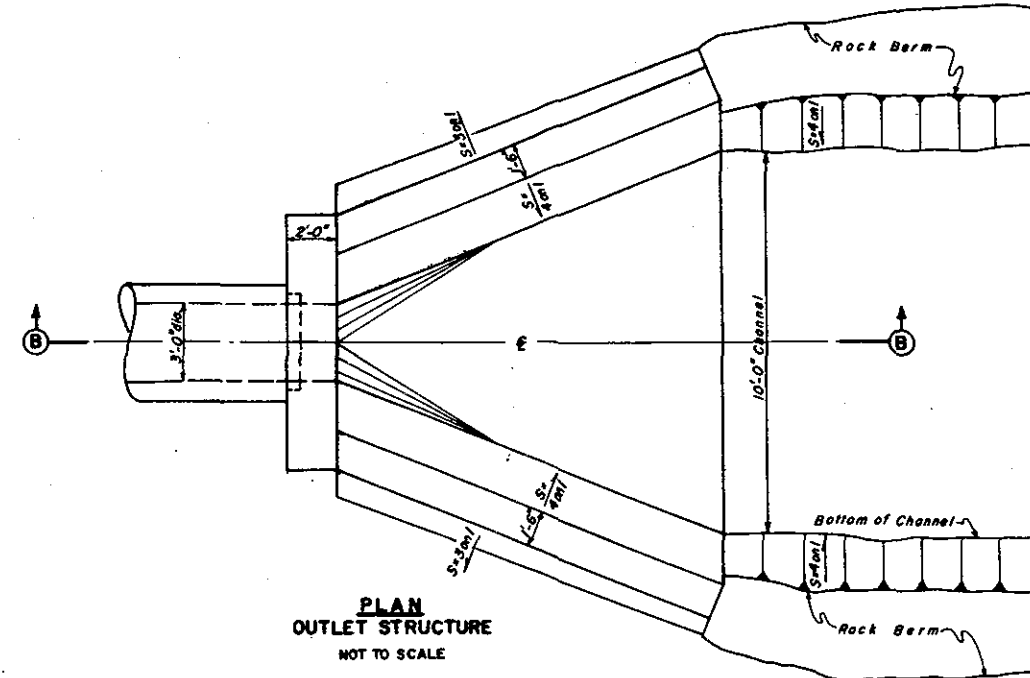
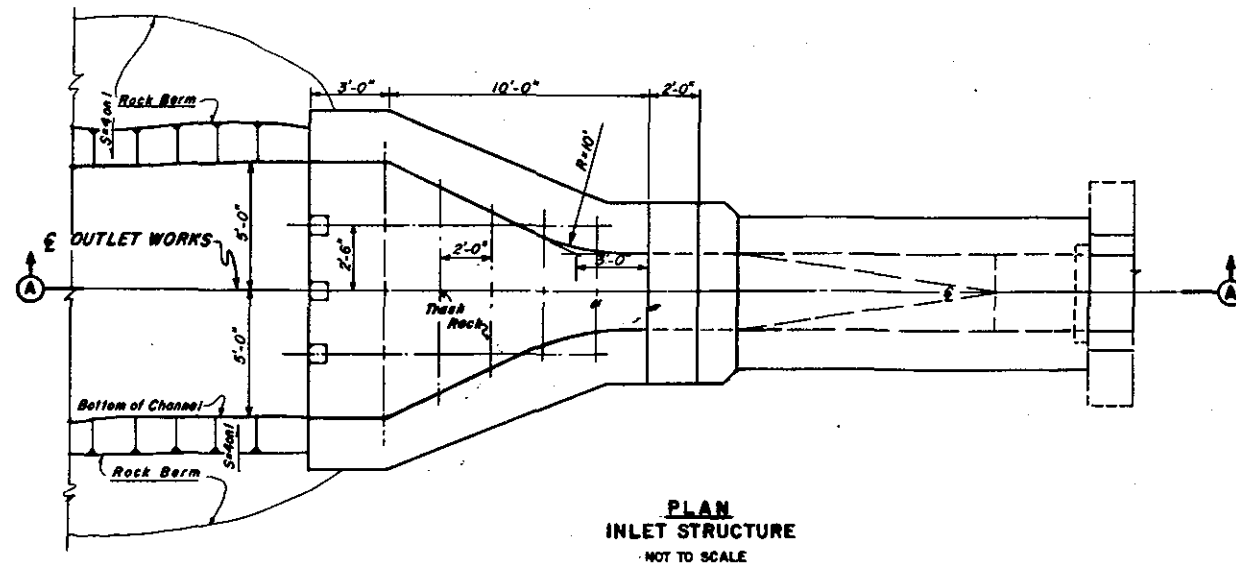
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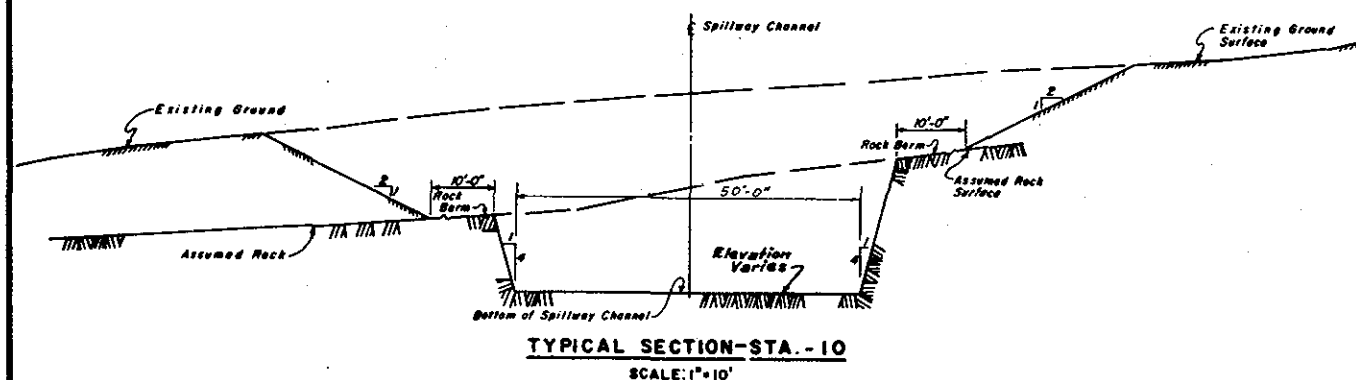
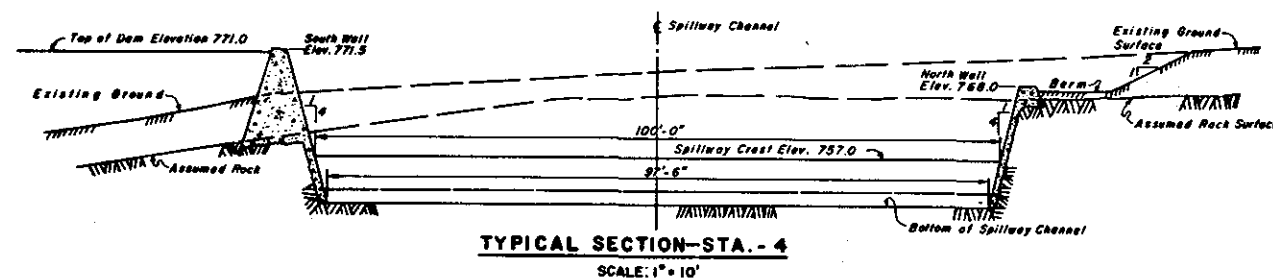
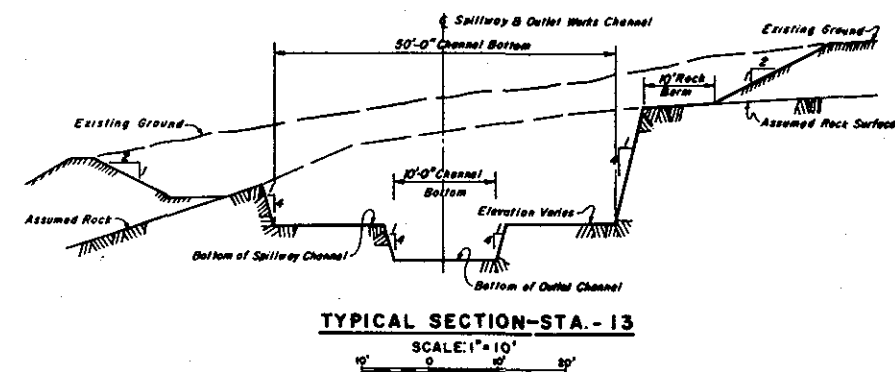
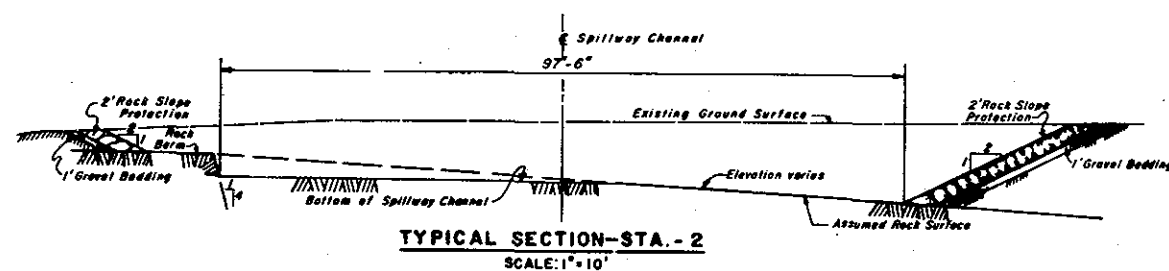
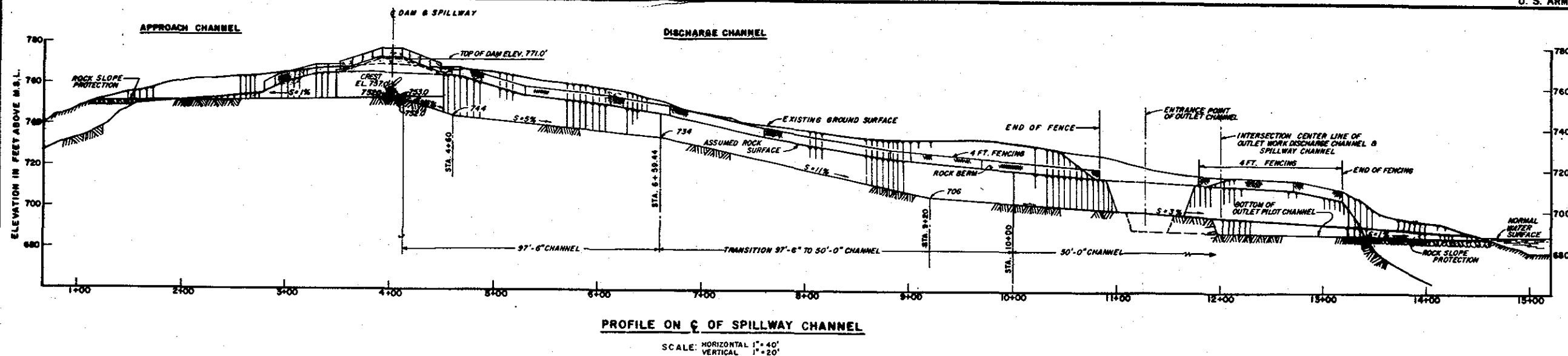


REVISED	DATE	DESCRIPTION	BY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
DR. BY	EA. BY	CL. BY	
CONNECTICUT RIVER FLOOD CONTROL CHICOPEE RIVER BASIN CONANT BROOK DAM DAM EMBANKMENT TYPICAL SECTIONS			
PROJECT ENGINEER		CHICOPEE RIVER, MASSACHUSETTS	
SUBMITTED BY		APPROVED	
CHIEF PLANNING & DESIGN		DATE MARCH 1963	
CHIEF ENGINEERING DIV.		SPEC. NO. CIV. ENG. - B-018	
SCALE		DRAWING NUMBER	
SHEET			



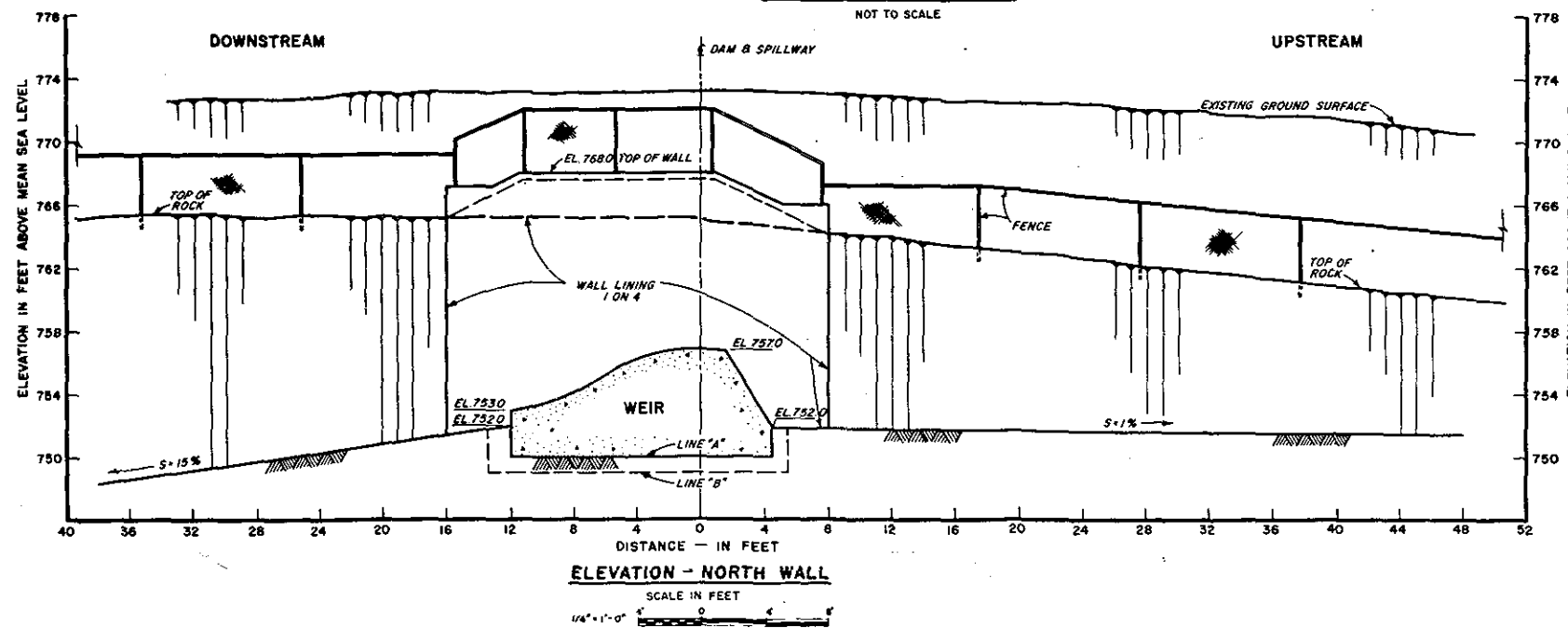
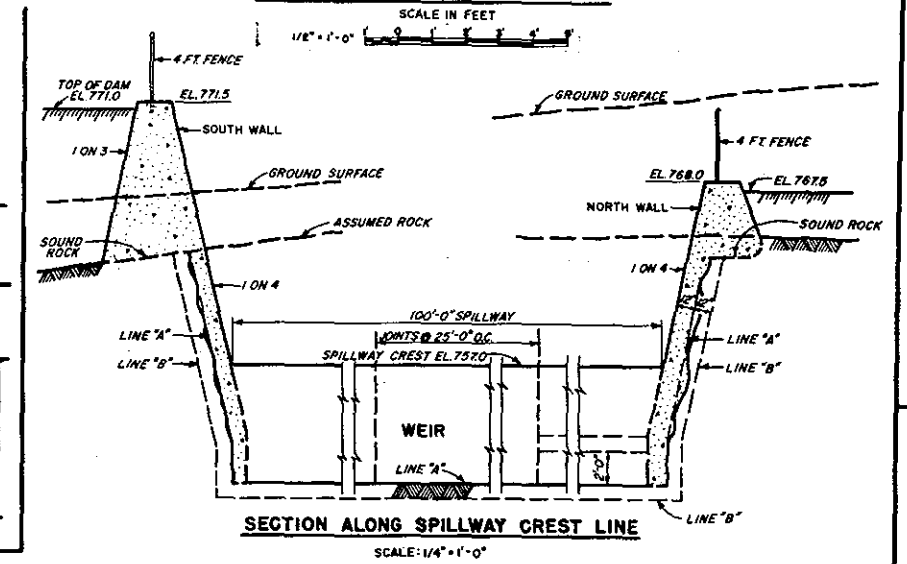
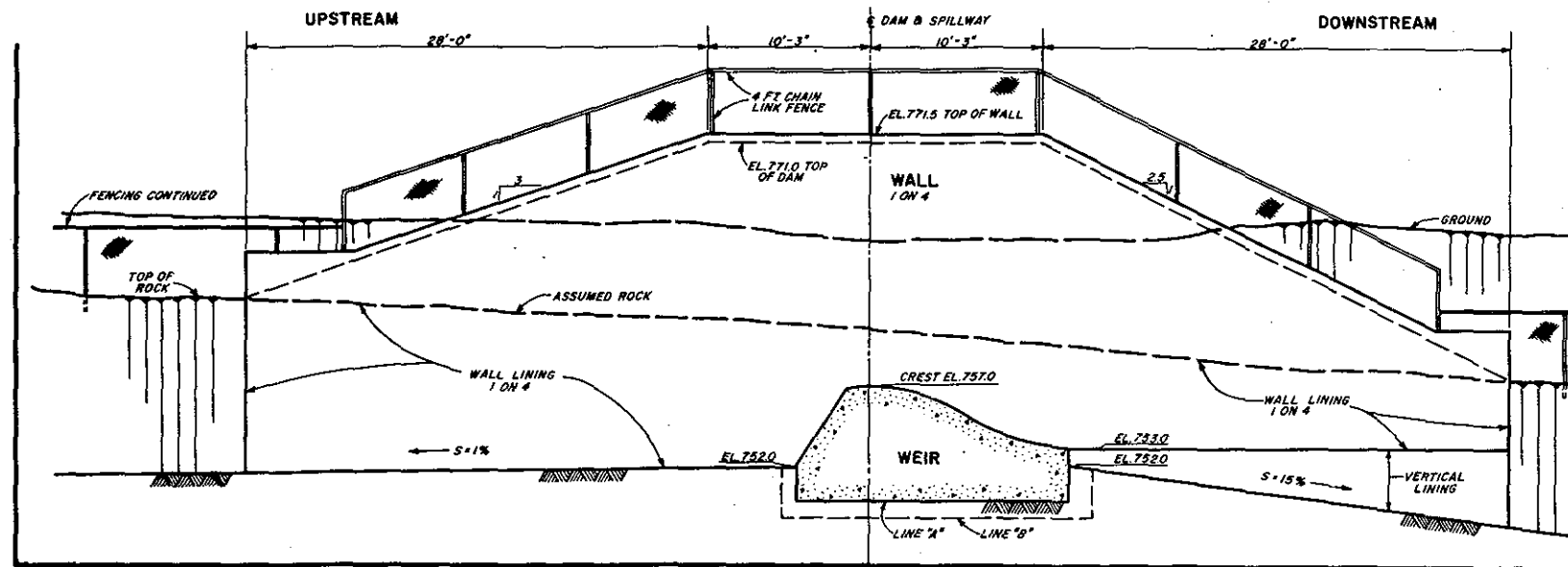
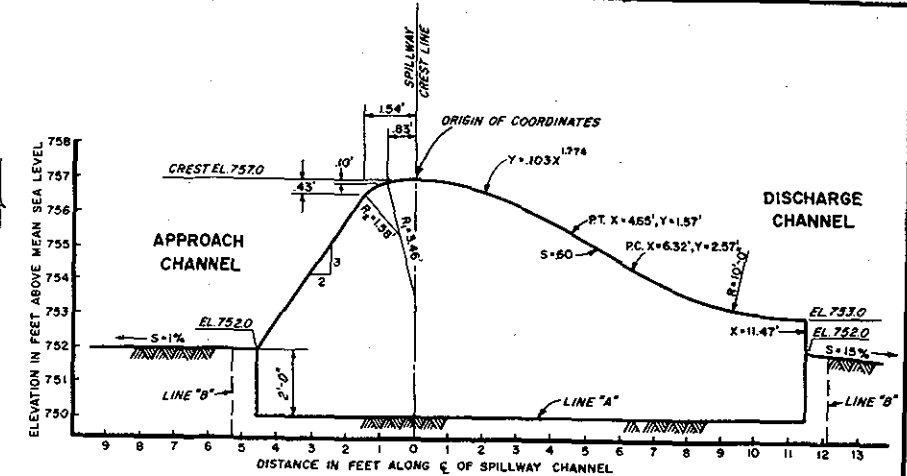
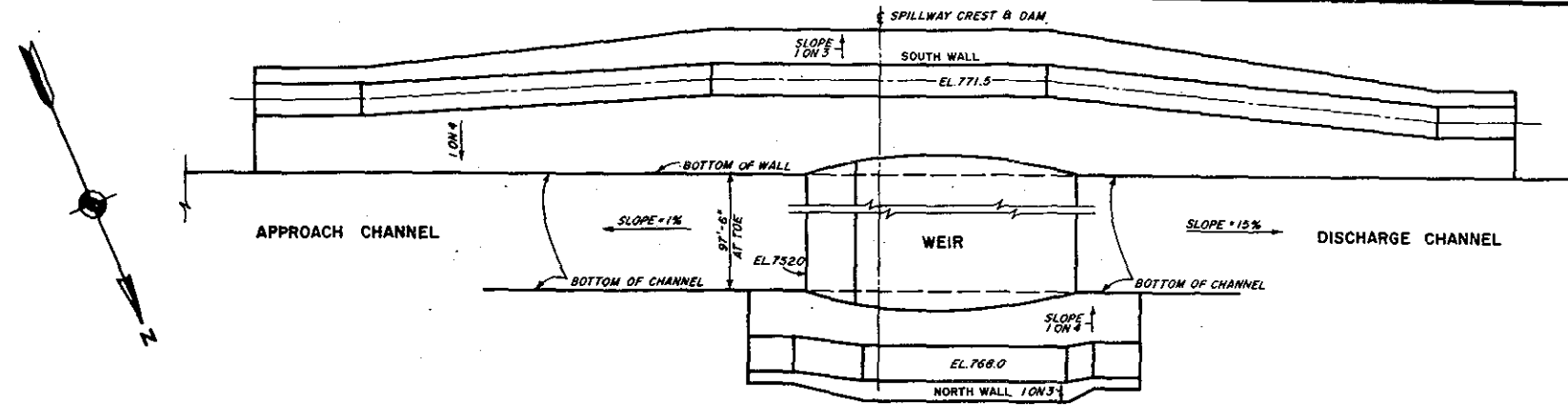
REVISION	DATE	DESCRIPTION	BY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
DR. BY	TE. BY	CR. BY	
M.W.B.	A.C.		
PROJECT NUMBER			
CHIEF	SECTION	APPROVED	DATE
SUBMITTED BY			MARCH 1963
CHIEF, PLANS & DESIG. BRANCH	CHIEF ENGINEERING DIV.	SCALE	SPEC. NO. CIV. ENG.-B-016
			DRAWING NUMBER
			SHEET

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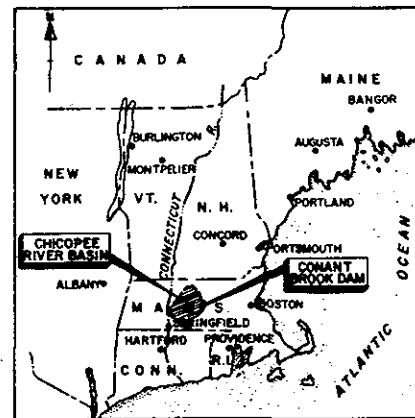


NOTE:
Outlet Pilot Channel between Station 11+30±
and Station 14+60±.

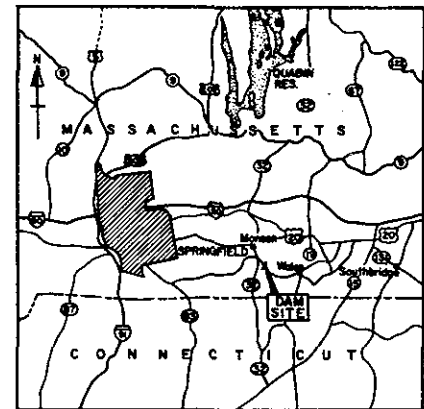
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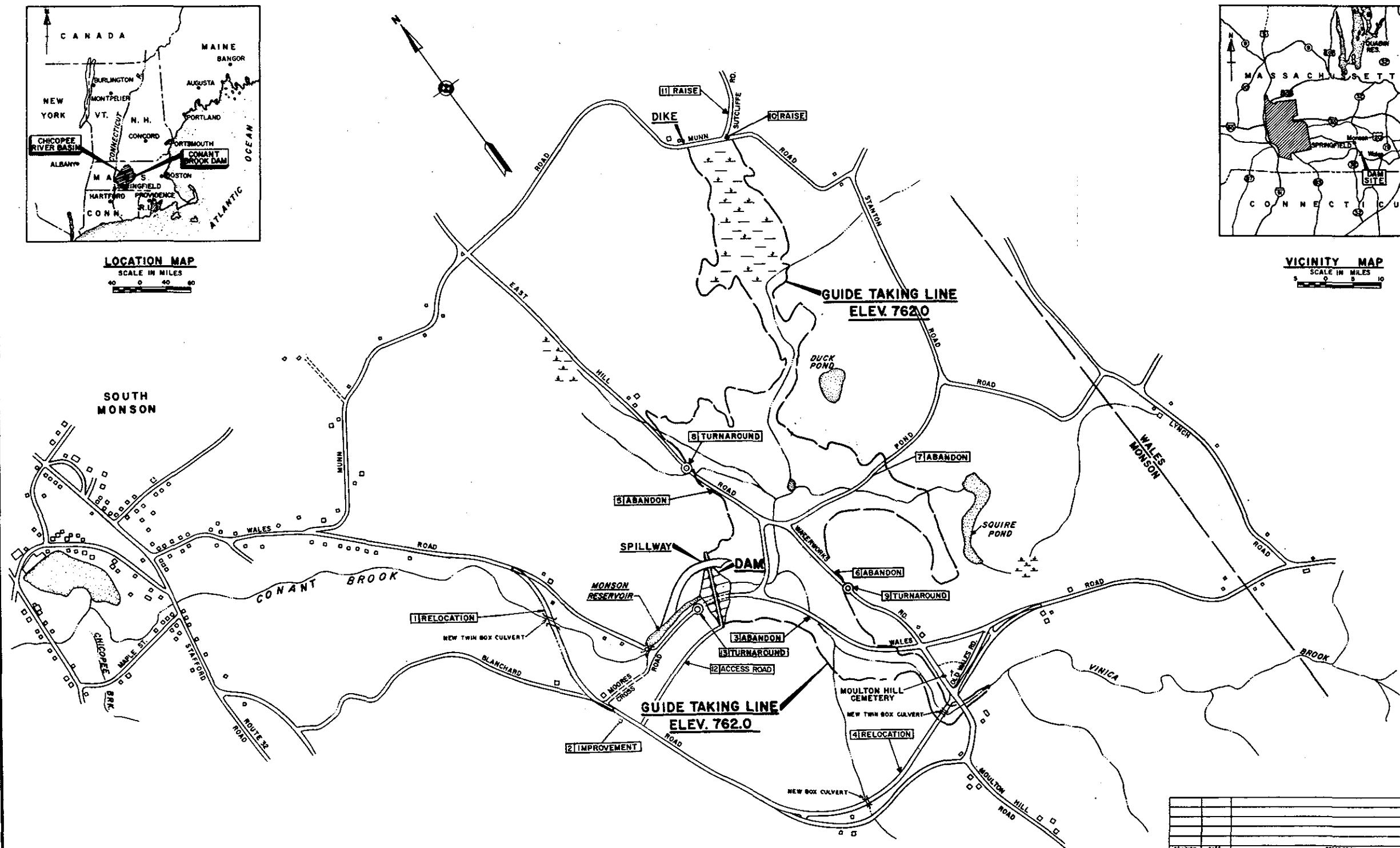
REVISION		DATE	DESCRIPTION	BY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.				
DR. BY	TR. BY	CL. BY	M.S.	
PROJECT ENGINEER				
CHEF	SECTION	SUBMITTED BY		
CHEF, PLANS & DESIG. BRANCH		APPROVED		DATE
MARCH 1963		SHEET		
SCALE		SPEC. NO. CIV ENG-10-018		
DRAWING NUMBER		SHEET		



LOCATION MAP
SCALE IN MILES
0 20 40



VICINITY MAP
SCALE IN MILES
0 5 10

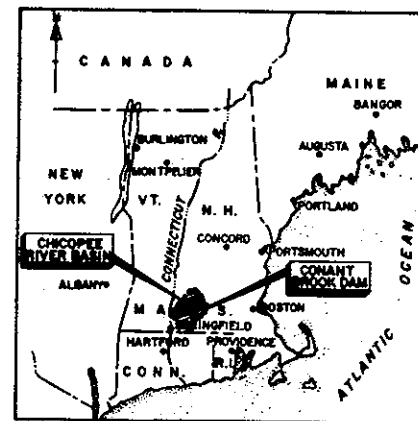


RESERVOIR PLAN

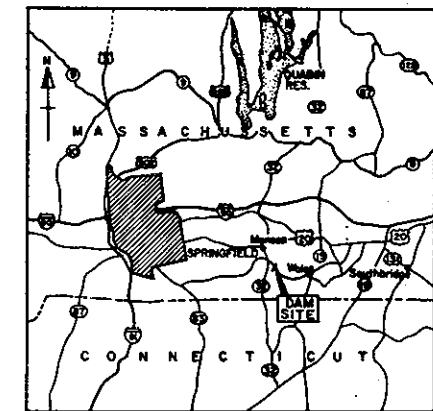
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- 6 FLOWAGE EASEMENT
- NUMBERS IDENTIFY LOCATIONS REFERRED TO IN SECTION OF DESIGN MEMORANDUM NO.
- ROAD TO BE ABANDONED
 - ROAD RELOCATION
 - FLOWAGE EASEMENT
 - ROAD TO BE RAISED
 - ROAD TO BE IMPROVED
 - ACCESS ROAD
 - TURNAROUND

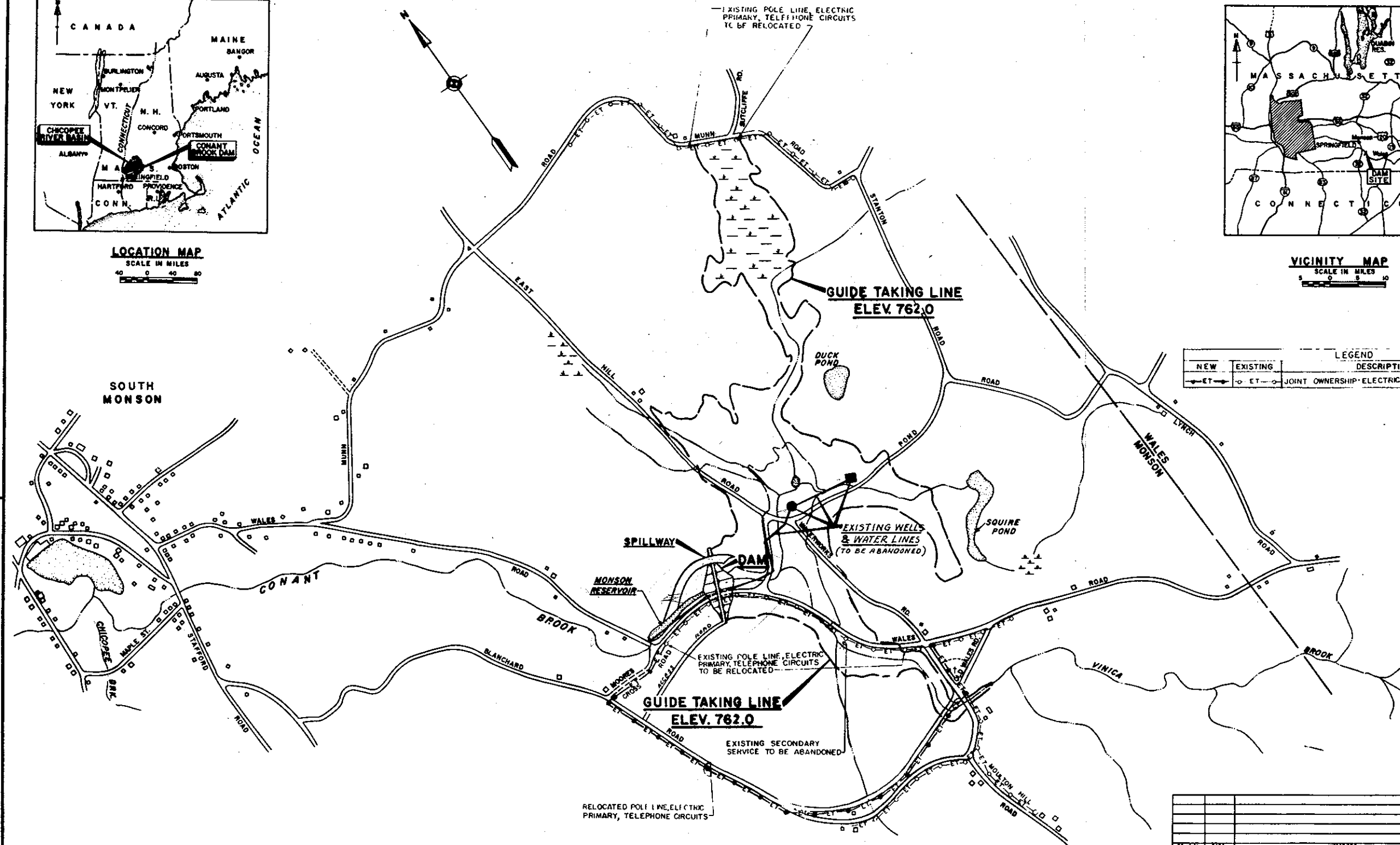
REVISION	DATE	DESCRIPTION	BY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
CONNECTICUT RIVER FLOOD CONTROL CHICOPEE RIVER BASIN			
CONANT BROOK DAM HIGHWAY RELOCATIONS			
CHICOPEE RIVER, MASSACHUSETTS		DATE MARCH 1963	
DESIGNED BY	SECTION	APPROVED	CHEF ENGINEER DIV
SUBMITTED BY		SCALE AS SHOWN SPEC. NO. CIV ENR-10-018	
CHIEF PLANNING & DESIGN BRANCH		DRAWING NUMBER HC-1-5877	
SHEET 1 OF 1			



LOCATION MAP
SCALE IN MILES
0 20 40



VICINITY MAP
SCALE IN MILES
0 5 10

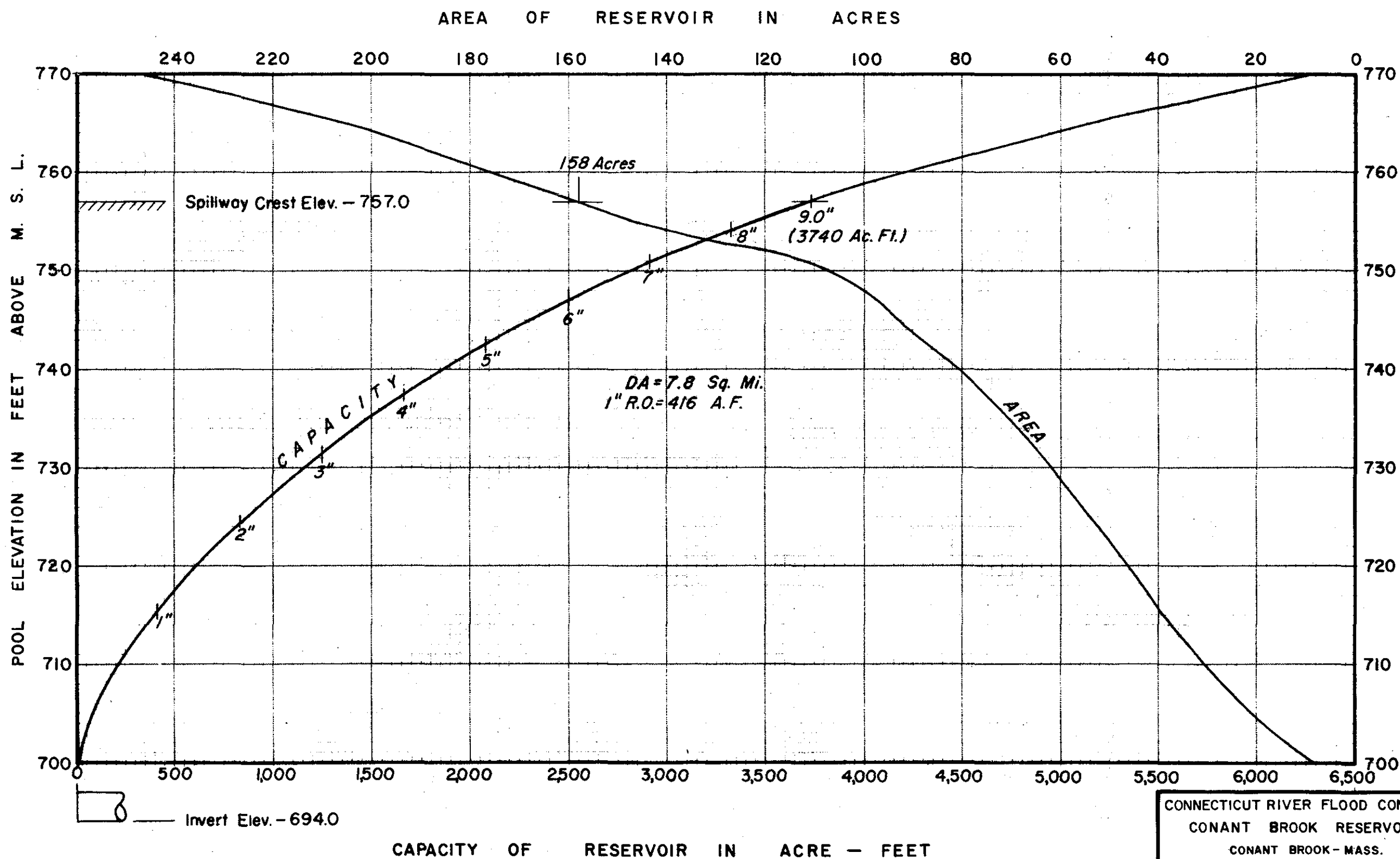


LEGEND		
NEW	EXISTING	DESCRIPTION
ET	ET	JOINT OWNERSHIP ELECTRIC & TELEPHONE

RESERVOIR PLAN

SCALE IN FEET
0 500 1000

REVISION	DATE	DESCRIPTION	BY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
DR. BY	TR. BY	CL. BY	
K.E.S.	R.S.P.		
PROJECT ENGINEER			
SUBMITTED BY		DATE	
CHIEF, PLANS & DESIG. BRANCH		APPROVED	DATE MARCH 1963
CHIEF ENGINEERING DIV.		SCALE: AS SHOWN SPEC. NO. ON ENR-8-518	
		DRAWING NUMBER	



CONNECTICUT RIVER FLOOD CONTROL
CONANT BROOK RESERVOIR
CONANT BROOK - MASS.

AREA CAPACITY CURVE

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.
MAR. 1963